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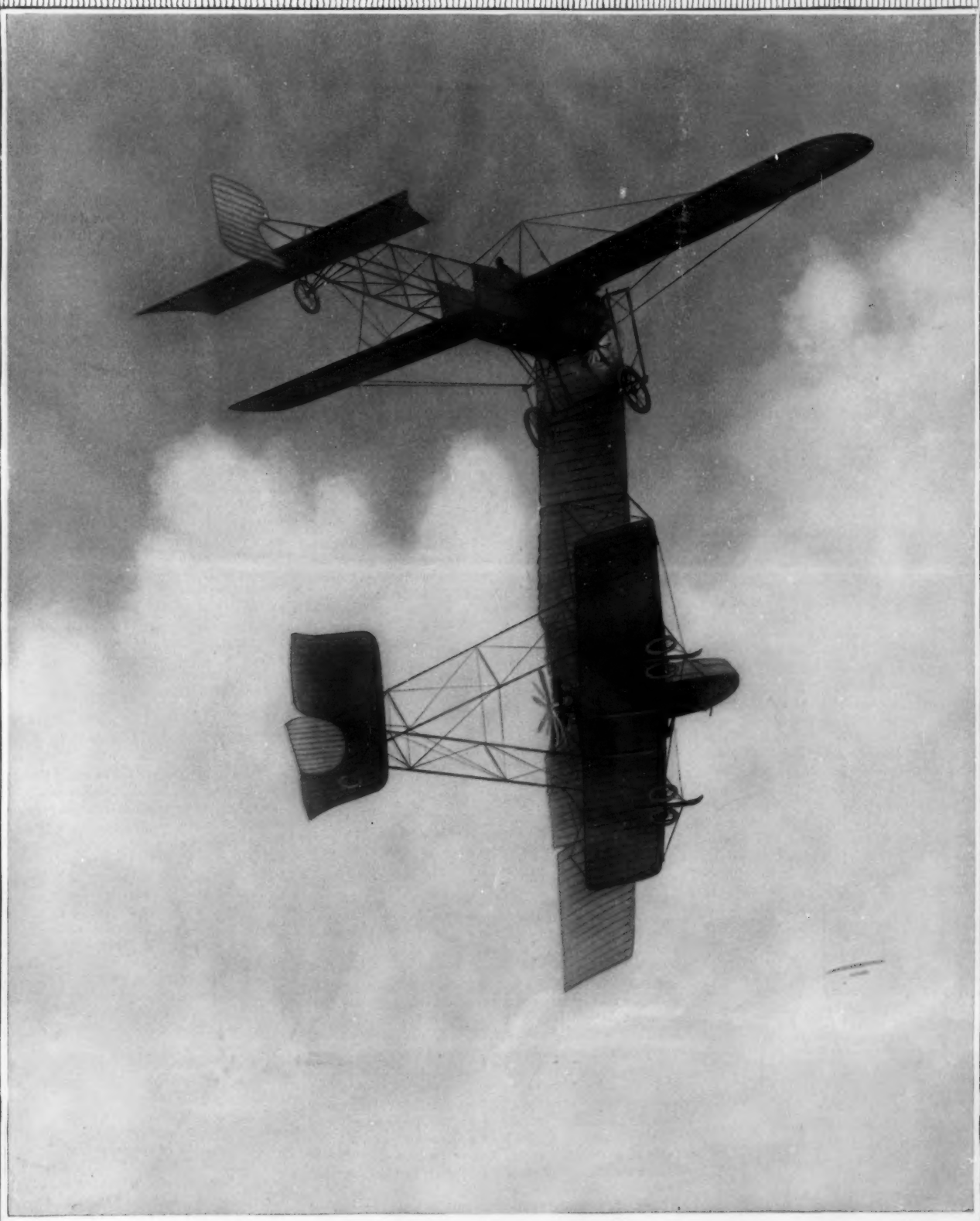

A CLOSE SHAVE IN THE AIR

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Possible Addition of Three Battleships This Year

IF the present negotiations and plans of the Navy Department do not miscarry, it is quite possible that provision will be made for the construction this year of three dreadnoughts. The two-battleship programme is certain of adoption, and, also, thanks to the pressing needs of one of the smaller European powers, it seems likely that the Government will authorize the building of a third capital ship of the largest size and power.

The purchase of a large modern battleship by Turkey has made it necessary for the Greek government greatly to strengthen its navy, if it is to hold its present superiority over the navy of its ancient foe. Negotiations have been opened for two of our pre-dreadnought ships, the "Idaho" and the "Mississippi," and the price which is named will be just about sufficient to cover the cost of a ship of the same class as the "Pennsylvania."

Of the more modern of our pre-dreadnought battleships, the "Idaho" and the "Mississippi" are the two which can be best spared; and this, not for the reason that they are not of first-class quality, but because they are what might be called an odd size and do not fit in well with our other ships of approximately the same date. The "Idaho" and "Mississippi," which are sister ships, were built under an authorization by Congress, in which, unfortunately, their displacement was definitely limited to 13,000 tons. They are small editions of the "Louisiana" and "Connecticut," the difference being that they are of 3,000 tons less displacement and of one knot less speed, that their armor is lighter, and that their broadside secondary battery is weaker by the omission of four 7-inch guns.

Except for these differences, they may fairly be considered as of the "Connecticut" class, and, therefore, they are thoroughly representative of the period immediately preceding the advent of the dreadnought. In fact, they were laid down the same year in which the first dreadnought was being constructed. Each ship carries four 12-inch 45-caliber guns and eight 8-inch 45-caliber guns in turrets, and eight 7-inch guns in a broadside battery on the main deck. Each ship has two submerged torpedo tubes of the new 21-inch type. The best recent speed of the ships has been a trifle over 17 knots. They are protected by a 9-inch belt associated with a 3-inch armored deck, and they have from 12 to 8 inches of armor on the turrets. The lower deck and the main deck in the wake of the 8-inch battery are protected by 7 inches of armor.

The purchase of these two battleships would mean a very great increase in the fighting strength of the Greek navy, of which, indeed, they would become the principal and most effective fighting units. At present, the most formidable ship in the Greek navy is the "Giorgios Azeroff," of 9,956 tons, carrying four 9.2-inch and eight 7.5-inch rifles, with twenty-four smaller guns. She did very effective work during the Balkan war, and her speed of 24 knots enabled her to attack when she pleased.

It is interesting to note that the powerful dreadnought recently purchased by Turkey is to be met by a Greek battle-cruiser, now under construction at Stettin, Germany, which will carry eight 14-inch and twelve 6-inch guns. But she will not be ready for some time to come, at least a year or two. Hence the advantage to the Greeks of the immediate possession of two such heavily armored ships as the "Idaho" and "Mississippi."

The Promise of Small High-speed Motors

ALTHOUGH it is still a little early to prognosticate with strict accuracy the multitudinous detail changes that will make their presence seen and felt in the new crop of automobiles that now are being started on their way through the great factories of the land, straws show which way the wind blows, and there is at least one feature that is practically certain to be very prominent. That feature is the small—or comparatively small—high-speed, high-efficiency four-cylinder motor.

During the past year we have seen the six-cylinder motor, and particularly the small six-cylinder motor, with a bore and stroke of about 3½ by 5 to 5½ inches, climb to great popularity; but now the pendulum seems to be swinging backward, and the small four-cylinder motor bids fair to step out into greater popularity than it ever attained before. Already a number of makers have announced 1915 cars that incorporate motors of this kind, and it is known that several makers, whose past year's activities have been devoted to exploiting small sixes, have practically ready for the market small four-cylinder cars, which will be released immediately the demand for sixes gives indication of dropping off.

For one thing, the notable success of a four-cylinder motor in the recent 500-mile race on the Indianapolis Speedway has given both the public and the designers food for thought. This motor, with but 183 cubic inches piston displacement, propelled its car at an average rate of 80.99 miles an hour; the car finished only seven minutes behind the winner, whose motor had 380 cubic inches piston displacement; it handily beat cars with displacements up to 450 cubic inches, which was the limit. But what is far more important, it kept on going—it demonstrated its reliability.

In demonstrating its reliability and its power, this tiny motor brought very forcibly to light the great truth in all engineering matters, that it is efficiency that counts. Efficiency means light weight, reduced friction, and above everything else, lowered operating cost. This is what the average motor-car owner desires. The cost of fuel already is high, in some places it is almost prohibitive. What we must have is high-efficiency automobile motors, and that is what we are going to get.

A few years ago speeds above 1,200 revolutions a minute were regarded as excessive, impracticable almost; yet now there are any number of foreign motors that operate normally at speeds up to 2,000 revolutions a minute. The answer is to be found in bettered workmanship and better materials. Practically all of the attention of foreign designers now is turning toward the production of small, high-speed, high-efficiency motors; they will have none of the big American motors, which are heavy and inefficient, and for that reason expensive to operate.

Only now is this foreign tendency toward high-speed, high-efficiency motors being felt on this side of the Atlantic. Already the practice has made inroads; it is coming slowly, and before long it will come with a rush.

The lightening of reciprocating parts, the reduction of internal friction to the minimum, the perfection of carbureting devices, and a general overhauling of the valve gearing and particularly of the valve timing, all are factors which are contributing to the success of the small high-speed, high-efficiency four-cylinder motor. These engineering problems are being solved slowly by the American designer, but progress undoubtedly is being made.

There will always be a market for the six-cylinder motor-car; there is no doubt of that. But has not the small six-cylinder motor been offered—or rather forced on—the public as an excuse for the lack of perfection of small four-cylinder motors?

To get the power we must have either large cylinders or high speed; we do not require both—not even in racing, as the lesson of that 183-inch motor points. Or, we must have a greater number of cylinders. Smoothness of operation may be left out of the question, temporarily, for the high-speed four-cylinder motor gives for ordinary purposes the continuity of torque that is given by a six-cylinder motor operating at lower speed.

So, as the cost of fuel remains high, large cylinders steadily are being relegated to the background, and designers are falling back on greater speed. And this is as it should be; for in lighter engines operating at higher speed we find greater efficiency, and that is what everyone most desires.

That the forthcoming year will see a very marked increase in the popularity of the small high-speed motor of the type under discussion there can be no doubt. It is only to be regretted that someone did not take the cue from our foreign brothers a long time ago.

Physical Law in Economics

AN economic system resembles in certain respects a physical system in a state of strain. Such a system represents a fund of potential energy, since the strains tend to become annulled by readjustment of the matter and energy in the system. Thus, for example, if we seize the center of an elastic band stretched between two supports, and pull it toward one end, a state of strain is created such that upon releasing the hold upon the displaced center, the latter returns to its original position. A point which should be noted is that in such case energy is so redistributed that it passes from regions of *greater* tension to regions of *lesser* tension.

Somewhat similar conditions prevail in an economic system. A number of "owners" possess various commodities to which they attach varying value, varying "tension." They exchange portions of their property until each has such an assortment of property as best satisfies his desires. In each case *property* passes from a point where *less* value is attached to it to a point where *greater* value is attached to it. At first sight this may appear to be just the opposite of the conditions observed above, relative to the readjustment of energy. But a closer inspection shows that the analogy holds good. For, as in the case of the elastic we had to consider the passage of *energy* from one half of the elastic to the other, and not the passage of *matter* (which takes place in the opposite direction in this case), so in the present instance we must think, not of the passage of *matter* from one owner to the other, but of the changes in the *energy* of the system. To make this clear consider a simple and somewhat extreme case. Suppose that *A* possesses such a large quantity of some commodity, bread we will say, that he can spare several loaves without feeling any appreciable loss. Let *B*, on the other hand, be nearly starving. In these circumstances it will require but little provocation to induce *A* to part with a loaf and pass it on to *B*. In this case, plainly, *matter* has passed from a point where a low value was attached to it, to a point where it is highly valued. But what are the conditions as regards *energy?*

B was near starvation, and willing to do practically anything within his power to obtain the bread. He was a source of available energy. *A*, on the other hand, was rather indifferent as to his possession of two or three loaves of bread more or less. He was not nearly as ready a source of energy as *B*. After the passage of the bread has been effected, *A*, having now less bread, is somewhat more susceptible to persuasion to do work to obtain bread, while *B* is less so, now that his hunger is satisfied, than he was before. We see, then, that potential energy may, indeed, be said, in this case, to have passed from *B* to *A*, from the point where *greater* value was attached to the commodity to that at which *less* value (tension) was attached to it.

The application of laws of energetics to the field of economics has been foreshadowed occasionally by such writers as Helm, but it cannot be said that the subject is, as yet, at all fully worked out. There seems reason to expect that the future may bring important developments in this direction.

Antivivisection Literature

WE have had occasion in the past to refer to some of the illogical and vicious practices of antivivisectionists. Unfortunately many who read the distorted accounts and misrepresentations emanating from these misguided persons have not the means of distinguishing the truth from falsehood. We have in mind an article which recently appeared in a popular magazine of wide circulation, and which showed pictures of animals seemingly undergoing torture by the applications of various gags and other instruments. Such pictures are greatly misleading. In the first place, most of the instruments shown are used only in conjunction with an anesthetic, and secondly, the appearance of ferocity of the gags, for example, is entirely spurious. Such gags are used merely to keep the mouth of the patient open where circumstances demand it, and are in no wise painful, even if no anæsthetic were used. Dr. Keen, in a paper entitled "The Influence of Antivivisection on Character," shows a picture of his little granddaughter photographed with such a gag in her mouth. The child, so far from resenting the process, looked upon the proceeding of being photographed with her mouth wide open as an amusing prank.

It is almost incredible to what lengths of falsehood and suppression of the truth antivivisectionists will go. The impression is persistently conveyed that vivisection is commonly practised without anesthetics. As a matter of fact, even if the operators were as inhuman as antivivisectionists seek to paint them, the use of anesthetics would be imperative in the great majority of cases, because the struggles of a suffering animal would make delicate operations absolutely impossible, to say nothing of the danger of injury to the operator.

It is to be feared that much harm has been done by the grossly misleading publications emanating from antivivisectionist quarters, and we take pleasure in bringing before our readers, in this week's issue of SUPPLEMENT, an exposure from the pen of Dr. Keen, of some of the wickedly deceitful methods employed by these foes of scientific and humanitarian progress.

Electricity

Electric Roll-Caller.—There are 435 members in the House of Representatives. It takes 45 minutes to call the roll. In order to avoid the tedious delay, an electric voting device will probably be installed before the next session begins in December. It is estimated that it will cost $20,000 to establish the system.

Electricity and Food.—At the recent session of the National Electric Light Association, in Philadelphia Mr. T. C. Martin gave an interesting report on the electrical stimulation and plant growth. He announced that vegetables, such as radishes and lettuce, when subjected to electrical treatment, had shown a 75 per cent increase in growth over untreated vegetables. Evidently electricity is destined to play an important part in the production of our food.

Electricity from Coal.—According to press reports, Thomas A. Edison is now engaged with the problem of producing electricity directly from coal, and declares that it will be accomplished some day. If Edison succeeds in solving this problem, it will be without doubt his greatest contribution to the good of man. It will mean a great economy in coal consumption if he finds a way of converting all or nearly all the stored energy of coal into electricity. Others have tried to do this but so far have succeeded in converting only a small proportion of the energy.

Wireless in the South Orkneys.—According to the *Geographical Journal*, there is now wireless telegraphic service from the South Orkneys, through the South Shetlands, to the Falkland Islands, and thence to the rest of the world. The South Orkneys, on the verge of the Antarctic, are the site of what has hitherto been the most isolated meteorological station in the world, an important outpost of the Argentine meteorological service. The linking of this station with the world by wireless will be as notable an event as was the recent inauguration of daily wireless weather reports from Spitzbergen, in the Arctic.

Recent Advances in Radio-Telephony.—A great deal of activity is now being displayed in the field of radio-telephony. Many experimenters are reporting progress. In France, Com. Victor Colin and Lieut. Maurice Jeance have transmitted speech over a distance of 150 miles. It will be recalled that these two inventors held long distance wireless conversations five years ago. Mr. William Marconi expects soon to establish wireless telephone communication between his office and his country house, a distance of 67 miles. According to press accounts, Marconi has succeeded in talking with Berlin, which is 600 miles away. This, if true, is startling indeed. However, it will be recalled that, some time ago, press dispatches stated that Marconi had transmitted speech over 1,000 miles. Later it appeared that the communications referred to were in the form of dot and dash signals instead of speech.

Wireless Weather Forecasts for Great Lakes.—A daily weather bulletin for the Great Lakes is now being sent out from the radio station at Radio, Va., according to an agreement just arrived at between the United States Weather Bureau and the United States Naval Radio Service. This bulletin is sent out in two parts. The first consists of code letters and figures describing the weather conditions actually prevailing at 8 P. M. that day at various points along the Great Lakes. The second part of the bulletin is a special forecast of the winds that will probably be encountered on the Lakes. This is distributed to shipmasters on the Great Lakes by the Naval Radio Service during the season of Lake navigation—usually from about April 15th to December 10th—in the same way that weather conditions for the North Atlantic Ocean and the Gulf of Mexico are sent out. The latter service was begun in July of last year. It proved popular, and the Weather Bureau was encouraged to extend the service to the Great Lakes.

Resistanceless Conductors, Hence Permanent Electromagnets?—For many years the laboratory of Prof. Kammerlingh Onnes at Leyden has been the center from which some of the most important advances in low temperature research have been announced. It will be remembered that the Dutch physicist was the first to liquefy helium, the most refractory of all known gases, and that in the course of these experiments the lowest temperature on record, within a degree or so of absolute zero, was obtained. Of late, attention has been centered on the remarkable influence of temperature on the electrical resistance of metals. This resistance is found to become practically zero before the absolute zero of temperature is reached. Recent newspaper accounts state in somewhat vague terms that remarkable new developments have followed in the train of this work on the conduction of electricity at low temperatures. The question arises, what happens to an electric current once started in a conductor of zero resistance? Its energy is not dissipated as heat, since the ohmic effect is non-existent. Does the current continue to flow indefinitely? If so, a closed loop carrying a current would function as a permanent electromagnet. It is rumored that something of this kind has been observed. We shall await further news with interest.

Science

A Mount Rose Snow Sampler and Weigher, designed at the Mount Rose Observatory, has recently been ordered by Dr. A. de Quervain, Director of the Meteorological Service of Switzerland, for the use of the Swiss Gletscher-Kommission in the Alps. The sampler is to be 20 feet long and made in sections of 5 feet to facilitate being carried to the more inaccessible portions of the mountains. During the present season depths of 180 to 260 inches have been reached on several occasions. The density of the snow at these depths has been ordinarily 46 per cent, but the United States Weather Bureau, which has placed one of the samplers in Nevada, reports densities as high as 76.3 per cent.

An Insect Menagerie.—What Prof. Habitte calls his insect menagerie is installed at one of the laboratories of the Jardin des Plantes establishment, and he now has upward of fifty well-arranged boxes or cages where he observes insect life. He thinks that this should be enlarged into an "insectarian," or extensive menagerie, to which the public should be admitted. This is already done in some countries and their usefulness is recognized. No great expense is needed, all that is required being a hall with large tables on which the insect cages are placed in good view, with glass or wire-gauze covers. The insect world is of greater interest than may perhaps be imagined, and no doubt such an enterprise would be much appreciated by the public.

Animals that Never Drink.—It would seem that water is so indispensable to life that no animals could exist without drinking. Nevertheless, Dr. Blanford asserts that the antelopes which live in the sand desert between the salt lake Chilka and the sea never drink. This has been doubted by physiologists, who deny that existence is possible in such conditions, but confirmatory evidence is now adduced by Dr. Drake-Brockman. It appears that since 1910 a troupe of gazelles have lived in the small island Saad-ud-Din on the side of Somaliland, where there is no source of water and where the annual rainfall is less than three inches, so that these gazelles cannot obtain water except after very rare showers. The vegetation is very poor and they cannot supplement the lack of water during the dry season by consuming roots and bulbous plants rich in liquid.

"Lithia Water."—A signal illustration of the importance of the Food and Drugs Act is reported in a recent circular from the office of the Solicitor of the Department of Agriculture. In a case brought by the Government to condemn a consignment of alleged lithia water, offered as a remedy for various serious ailments, it was proved that the water in question contained lithium only in the proportion of about one grain in 10,000 gallons. As the average dose of this remedy as a uric acid solvent is from 5 to 7½ grains three times a day, it would be necessary for a person to drink from 150,000 to 225,000 gallons of the water a day in order to obtain a therapeutic dose. It was also shown that ordinary Potomac River water contains five times as much lithium as this so-called lithia water.

"Tango Foot."—Housemaid's knee, miner's elbow and similar ailments have now a formidable rival in "tango foot." In a recent number of the *Medical Record*, Dr. Gustav F. Boehme, Jr., states that he has recently been consulted by a number of dancers who complained of "pain in the front of the foot." In every instance, he found the same symptom-complex, and on investigation, discovered the cause constant—the modern dance. Says the doctor: "The latter day dances, especially the tango and the maxixe, and to some extent the complicated figures of the hesitation waltz, call for great flexibility of the ankle, with much movement at this point throughout the various intricate steps. The more common movements are those of extension, flexion, and adduction of the foot. The resultant is a constant strain on the extensor muscles of the foot, viz., the tibialis anticus, the extensor longus digitorum, and the extensor proprius hallucis, which in turn produces a tenosynovitis in this muscle group. The commonest tendon involved is that of the tibialis anticus.

The Kara Sea Route to Siberia is nearly always practicable during at least the months of August and September, according to E. Lesshaft, who has published in *Annalen der Hydrographie* a painstaking discussion of the ice conditions in that sea, as reported by vessels during the last forty-odd years. It has happened only once or twice that the sea has been entirely filled with drift ice during the months named; there is normally a large area of open water, but its location varies from year to year. In order that the route may be used, it is necessary for mariners to know in advance only which portion of the sea is open, in order that they may choose the appropriate entrance and steer the most favorable course. The distribution of ice depends upon that of barometric pressure, which can be determined by observations in Nova Zembla and at the mouth of the Obi River, and in both places meteorological stations already exist. As soon as these stations are connected with the world by telegraph, the important problem of using the Kara Sea as a highway to Siberia during a limited period each year will be solved, according to Herr Lesshaft.

Automobile

Cyclecar for Land and Water.—Amphibious cars are not new, of course, but lately one has been brought out in England which appears to be quite successful. It is a sort of combination cyclecar and boat. It is powered with a 4½ horse-power single-cylinder water-cooled motor which drives the vehicle while on land through a chain and two-speed gear set. There is a clutch for changing the drive from the rear wheel to a tail shaft upon which the propeller is mounted. The body, of course, is a boat hull. While the single rear-wheel drive is not ideal for helping the vehicle out of the water and up banks, the possibility of this combination has been demonstrated.

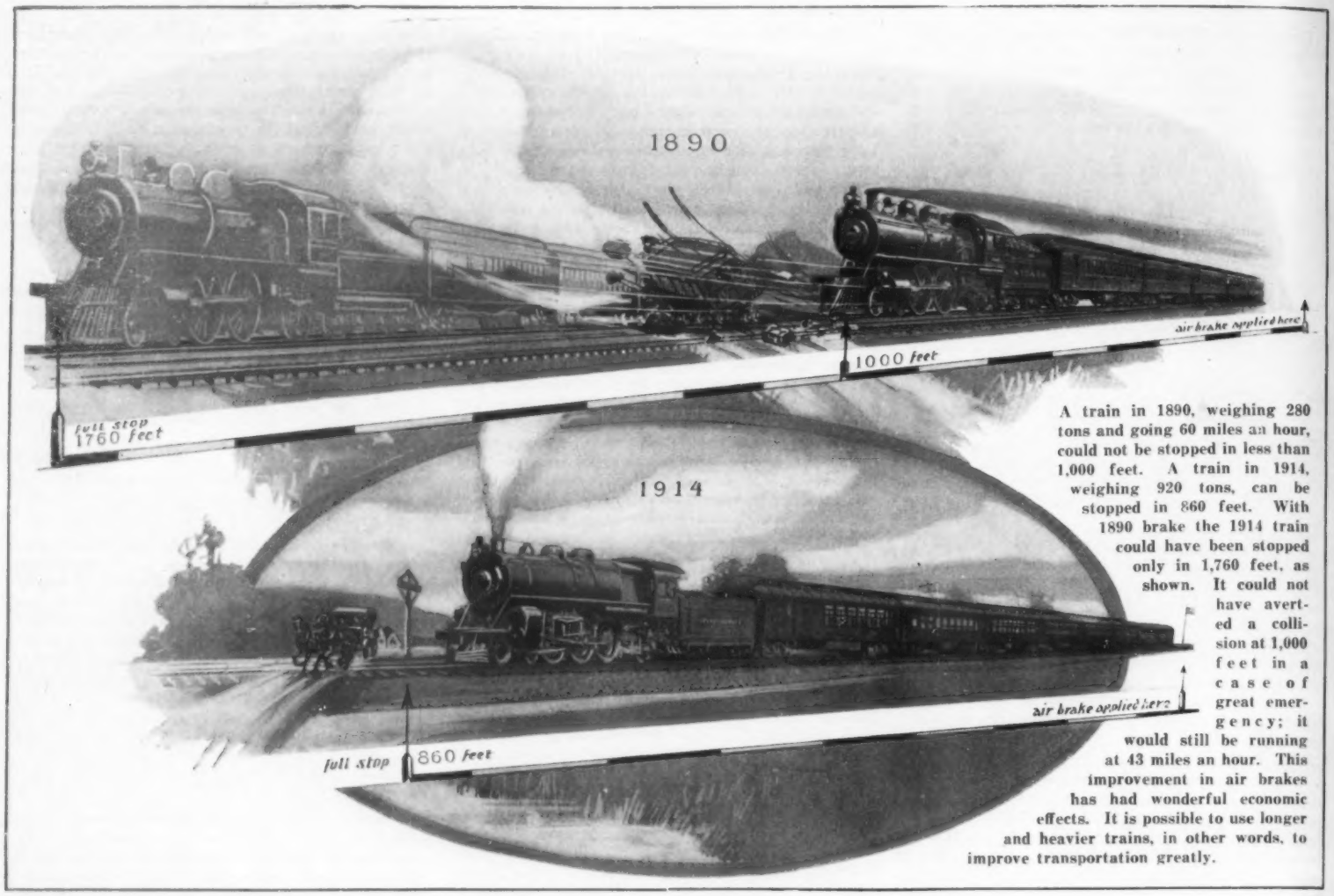
An Improvement in Air Cooling.—A British engineer has been quite successful in increasing the heat radiation of an air-cooled motor by the simple expedient of attaching to the existing iron fins a number of aluminium fins. Aside from increasing the radiating surface, the aluminium is a much more efficient radiating medium than is the iron. The extra fins are merely clamped to the existing iron ones, the only requisite being that a good contact is obtained. In a bench test in which a four-cylinder motor was raced for a considerable time, the radiating fins could at all times be held in the bare hands. Their temperature does not go higher than about 15 degrees above the temperature of the surrounding atmosphere.

A Russian Automobile Contest.—The Russian event for automobiles, known as the Czar's Cup, organized by the Imperial Automobile Club, will be held during the month of August. The route is laid out from Moscow, Rostoff, Tiflis, Kherson, to Odessa. Cars admitted to the race must be of standard types published in catalogues at least six months before the date of the event, but any size of motor can be used. Standard four-place car body is to be provided, and the cars are to carry at least two persons, including driver. There will also be held three speed tests on this occasion, one at Rostoff and another at Odessa upon one kilometer length on level grade, and a third at Tiflis on up-grade for several miles length.

A Million Hides for Automobile Upholstery.—As an indication of the tremendous size of the automobile industry, it is interesting to note that in one year approximately 1,000,000 hides are used for upholstery purposes. The ordinary roadster body requires little more than two complete hides, and the touring body about three hides. The average per car therefore is 2½ hides. The average area per hide is about 50 square feet, so that 50,000,000 square feet of leather is used. From the time the hide is stripped from the animal, it requires from 10 weeks to 6 months completely to prepare it for use, the time varying with the quality of the leather. Each hide is split into four grades which are known as hand buffs, machine buffs, deep buffs and splits. The hand buffs are the best and are the part nearest the hair. This is the quality that is most used in the best motor car factories.

Making Bodies with Wood Cement.—Apropos of the suggestion made in this column some time ago that motorcar bodies might with profit be made of *papier maché*, it is interesting to note that a firm of French builders recently has perfected a method of using what is styled wood cement for this purpose, apparently with considerable success. In using the material, the exact composition of which is kept secret, the body is built of a light framework over which is stretched wire netting. The wood cement is then literally plastered on with a trowel. It dries quite hard in twenty-four hours, after which it can be planed like wood and is capable of taking a very high finish. The weight of the finished body is approximately the same as the weight of an ordinary wooden one. One valuable feature of the construction is that repairs are very easily made. In case of breaks caused by collision, etc., it is necessary merely to plaster up the hole and refinish the body. The material does not chip nor disintegrate, is impervious to water, heat or cold, and is practically incombustible.

A Dozen Lamps in Place of Four.—A British accessory manufacturer has attacked the automobile illumination problem in a brand-new manner. Instead of using four lamps, two of them high-power for touring and two much smaller for city driving, he provides no less than twelve small lamps, which are arranged in a row in the filler board between the wind shield and the top of the engine hood. During the time the lamps are not in use they are completely covered by a sliding shutter. For city driving only the two outside lamps are lighted. Where more light is required more lamps are lighted, and when the maximum illumination of the road is necessary, all of them are turned on. The most important feature of the arrangement, however, is that the angle of the group of lamps can be varied at the will of the driver so that any part of the road can be illuminated, sign posts can be shown up, or, on occasion, the reflectors can be shifted so that the light is turned down onto the engine for repairs at night. The lamps are shifted by a simple worm and gearing which is operated by a small hand-wheel placed upon the dash of the car. Another advantage is that the row of lamps does not mar the outward appearance of the car as do the ordinary lamps.



A train in 1890, weighing 280 tons and going 60 miles an hour, could not be stopped in less than 1,000 feet. A train in 1914, weighing 920 tons, can be stopped in 860 feet. With 1890 brake the 1914 train could have been stopped only in 1,760 feet, as shown. It could not have averted a collision at 1,000 feet in a case of great emergency; it would still be running at 43 miles an hour. This improvement in air brakes has had wonderful economic effects. It is possible to use longer and heavier trains, in other words, to improve transportation greatly.

Forty-five Years of Air-brake Evolution

By A. L. Humphrey

Vice-President and General Manager of the Westinghouse Air-Brake Company; Former Superintendent of Motive Power of Chicago & Alton and Other Railroads

FORTY-FIVE years elapsed between the first trial of the air brake and the death of George Westinghouse, an event which has taken, untimely, a discoverer of momentous things and bereft his associates of an inspiring leader. Most people know that the celebrated inventor was throughout that half century so greedy for work that somebody said "he has put a brake on every train but he cannot put a brake on himself"; but the air brake does not figure in the common thought as the basis of any of these later triumphs. It is looked upon rather as having sprung from his brain, perfect and complete. To those of us who had the rare fortune in any part of that period to be his colleagues or contemporaries in the manufacture and use of railway appliances this seems a grotesque and romantic notion; for the introduction of the air brake was only its birth. It has had a strenuous infancy, an eventful youth and a recent past of wonderful development. Maturity it cannot reach until transportation by rail ceases to progress. The quick action triple valve, brought out by Westingh-ouse in 1887, and the high-speed feature of the passenger train brake, added in 1894, have rendered a continuous service which in length of time, universality of application and degree of excellence is unapproached by any other mechanical device in common use at the present time upon railways. The past ten years have seen further notable advances.

A train in 1890, weighing 280 tons and going sixty miles an hour, had an energy of 33,000 foot-tons. The best air brake of that day, working to the top of its strength, could not stop that train in less than 1,000 feet. A train in 1914, weighing 920 tons and going sixty miles an hour, had an energy of 111,000 foot-tons, almost four times as much as what had to be dissipated in stopping the train of 1890. With the 1890 brake the 1914 train could have been stopped in perhaps 1,760 feet. As it passed the 1,000-foot mark it would still have a collision energy of 48,000 foot-tons (one and one-half times what the 1890 train had before the brake was applied), and it would still have 760 feet to run. That 1914 train with a 1914 brake can be stopped in 860 feet. At that point the same train with an 1890 brake would still be running forty-three miles an hour, with a collision energy of 57,000 foot-tons, or about twice that contained in the 1890 train at the beginning of the stop. It is not so much that the 1914 brake is bigger, as that it is different; and the laboratory has toiled through forty-five years to produce this doubling of the air brake's efficiency.

Safety Is Not the Sole Benefit of the Air Brake.

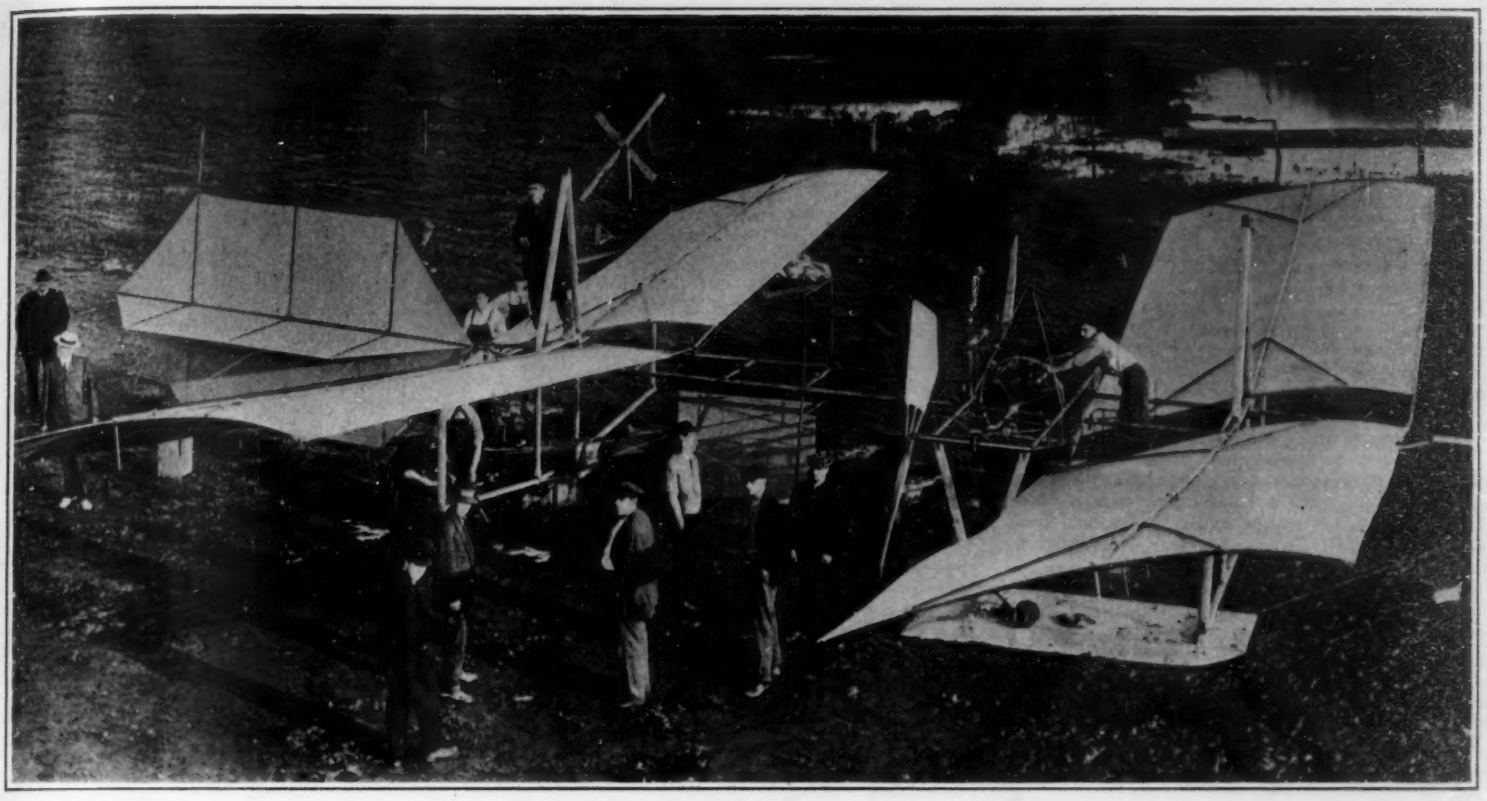
Another impression which many people have is that safety is the sole benefit from the air brake. That phase is a commonplace. When you read that an engineer did not stop you know that he probably could have stopped, since he had the means. To those who make or use it—to the railway manager racking his brain for ways to curtail controllable expense in order to meet other expense which is beyond control, the air brake has been and is one of the most effective of economizers. Think what it does. The train running at speed can be quickly stopped. What follows? That you dare run it at speed! And how does speed effect economy? By increasing the revenue which can be earned in a day by the crew; by the locomotive, which can haul a longer and heavier train; by the car, which will hold more tons; by the trackage, which can accommodate more trains a day; by the traffic solicitor, who can bring more freight and passengers if service is quicker. It is not alone that longer and heavier trains and more of them can be operated at speed, because the air brake will stop them when there is danger. Countless station stops, slow-downs and applications while descending grades are made to one emergency stop. The time saved in such routine operations and the larger use of plant, especially at junctions and terminals, due to quick stopping, without damage to cars or cargo, is one of the most important results accomplished in the whole brilliant history of organized railway endeavor for economical and efficient operation.

The commonest measure of economical railway operation is the average train-mile load. For the United States this average has risen from 175 tons in 1890 to 409 tons in 1912. Is it surprising that the railways have given and are more and more giving the most eager and systematic co-operation to the manufacturer in the development of air-brake improvements?

The growth of the brake to carry the modern burden has steadily progressed. Higher speeds, heavier vehicles, longer and heavier trains and their greater frequency increased the amount of work required of the stopping device. The effort consumed in stopping a given train going twenty miles an hour is four times that required at ten miles per hour. The brake shoe, which performs its function through friction against the wheel, is at a disadvantage, which is aggravated as the amount of work required within a given distance increases. A further loss occurs as the greater force is exerted through the foundation brake rigging and because of the longer time taken to obtain full braking power with large cylinders and larger trains. With longer trains, also, and their greater frequency, and with an increasing number of parallel tracks (each liable to accidents which pile up obstacles on adjoining tracks), an increase in the volume of air used interferes with the prompt and uniform response of the brakes to the manipulation of the valve, both when applying and releasing. This makes recharging more difficult and demands a larger available supply of compressed air. Another tendency which was manifested with enlarging train units was that the time elapsing between the action of the brakes at the head end and at the rear end of the train caused a bunching or stretching out of the slack between cars, and this interfered with its smooth handling. The increased risk, moreover, introduced with a greater number of parallel tracks and greater frequency of trains made mandatory that full energy of braking power be available at any time.

To enable the brake mechanism to perform this augmented and more complex task, the most obvious and essential step was to insure the best of use of the device as it stood. A poor brake well maintained and operated in the best possible manner will give better service than the best brake if neglected or carelessly handled. This meant systematic instruction of those responsible for handling of trains in service and for the care, inspection and maintenance of the brake mechanism. Both railroads and manufacturers developed trained corps of experts and special methods and apparatus for testing and repairing and provided technical literature and instruction paraphernalia, including elaborately equipped instruction cars and rooms. By organized efforts along these lines increasingly

(Concluded on page 510.)



The Langley "aerodrome" with the pontoons provided by Mr. Curtiss.

The Langley Aeroplane Construction and Control Mechanism

By Our Staff Correspondent at Hammondsport

THE brief flight of the Langley aeroplane recorded in these columns has since been several times repeated, and always with the same steadiness on the water and in the air. Efforts are now to be made to increase the thrust to meet the greatly augmented weight and resistance due to the added floats and trussing which unites them with the aeroplane proper. The present weight with Mr. Curtiss as pilot is 1,170 pounds; the old weight with Manly as pilot was 830 pounds. The increase of weight is, therefore, 40 per cent; the increase of flying resistance is of a like order, possibly greater, due to the augmented drift on the wings, and the head resistance of the floats and framing. It is believed that careful adjustment and some further trials will enable the engine to bear this excessive load in longer flight. If the launching had been made from ice, with light skates as the only added weight, a prolonged flight could have been made on the first trial, since there would have been an excess lift of approximately 300 pounds, and, of course, much less head resistance. Or if a slightly stronger engine were substituted, no careful adjustment would be required to achieve long flights.

The Langley aeroplane may be viewed either as a type or as an individual machine. As a type it seems to have been invented by D. S. Brown, and exhibited as a kite, in 1873, before the Aeronautical Society of Great Britain. The tandem arrangement of supporting surfaces also appeared in Hargrave's kites, and in Kress' aeroplane of 1893 and earlier; also in Langley's steam model flier of 1896; Montgomery's great glider of 1905; Blériot's first successful flier, patterned after Langley's large machine; also in some present-day fliers, notably Colliex's huge tandem biplane flying-boat, which is reported to have a useful load of 4,000 pounds, or a range of 1,000 miles, and has recently lifted with ease from the Seine. Langley's successful steam models and gasoline models were of both monoplane and biplane types.

The Langley "aerodrome" rising from the water.

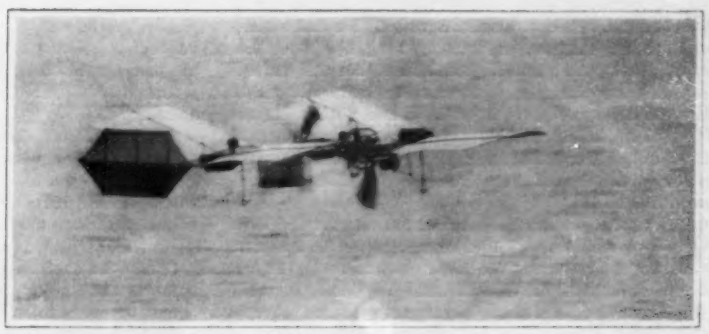
Floating the machine.

The Langley tandem aeroplanes are unique and highly original throughout. The large machine now at Hammondsport, which antedates its quarter-scale model, flown successfully above the Potomac in August, 1903, is a marvel of design and workmanship. It is the first aeroplane in history provided with an internal combustion motor; the first capable of carrying a man in sustained flight; the first man-flier with good enough inherent stability to take care of itself in moderate weather.

Langley's large "aerodrome"[1] is a tandem monoplane driven by twin propellers just aft the front planes. As seen from a distance, it shows four great dragon-fly wings and a long, double tail, all mounted on a long open steel frame, with a steering rudder beneath and abaft the center. The propellers on either side are connected by bevel gears to the engine ensconced in the frame just aft the fore wings. Posts for the numerous stay wires just above

[1] The term "aerodrome" was used by Langley to connote an "air runner" or any kind of heavier-than-air flying machine. It is now generally applied to an assemblage of buildings and grounds used for flying.

Ready for flight.



Flight of the quarter size model on which the man-carrying machine was based.

and below the frame at the wing spars, and a bowsprit protrudes from the prow. No running gear was provided, as the flier was originally to be shot from a catapult above a houseboat, and to land in the water after its voyage. The recently added pontoons, two flat ones in front and a cylindrical one at the rear, show conspicuously in the general view, especially when well out of the water.

The whole machine weighed originally 830 pounds, including the pilot; spread 1,040 square feet of wing surface; measured 52 feet from tip to tip, and 52 feet from the point of its bowsprit to the end of its tail; soared at 33 feet a second, and at a 10-degree angle of flight. The wings measured each 11 by 44 feet, arched one in eighteen at one fourth the distance from their front edge, and were covered only on their upper side. The double rudder, at the extreme rear, measured 95 square feet each in its horizontal and in its vertical surface. The vertical steering rudder measured about one square yard, and opened at the rear like a weather vane to give more grip at small angles.

The propulsion plant was most carefully designed and constructed. The gasoline engine weighed, without accessories, 125 pounds, and developed 52.4 horsepower in actual test at 930 revolutions a minute. With all accessories, including radiator, cooling water, pumps, tanks, carbureter, spark-coil, and battery, it weighed 200 pounds, or just 3.81 pounds per horse-power, a fine showing for the opening of the twentieth century. It could run ten hours continuously under full load, consuming about one pound of gasoline per horsepower per hour. Its five cylinders, arranged radially round a single crank-shaft, were made of steel lined with cast iron, and measured 5 inches in diameter by 5½ inches in stroke. By means of bevel gears it drove the twin screws, supported on steel tube brackets on either side of the steel tube frame, at 700 revolutions per minute, giving a thrust of 480 pounds, the screws being very nearly true helices, 8 feet in diameter, of unit pitch ratio, and 30 degrees width of blade, carefully formed of three radial arms covered with canvas.

Good inherent stability and fair manual control characterized the original machine. The lines of lift, propeller thrust and forward resistance passed through its center of mass, thus providing for projectile and gravitational equilibrium. The wings were set at a fair dihedral angle to give lateral stability. The rear rudder in level flight met the air at a negative angle of incidence, so as to check any serious diving; it was elastically connected to the main frame struts to dampen pitching; it was hinged to move up and down, but prevented by stays from moving sidewise. The pilot, seated in a little canoe under the fore wings, could steer up and down by working the big tail with a hand wheel, and steer right and left by working the wind vane rudder with another hand wheel. He had no lateral rudder, ailerons, or warping wing tips to control the lateral poise; but he could shift his weight several feet to right and left and fore and aft. Altogether the machine was quite as manageable as the famous Antoinette monoplane and Voisin biplane, which, in 1909 and subsequently, voyaged scores of miles in stiff winds, and achieved world records and prizes at international meets.

From what precedes it may be judged that the large Langley aerodrome of 1903 was capable, and is still capable, of sustained free flight with a man. It was intended only as an experimental aeroplane, to prove the feasibility of human flight, then to be provided with landing gear and otherwise better adapted to practical uses. But for the accidents in launching this machine, in September and December, 1903, Langley would undoubtedly have inaugurated the era of successful human flight, if the present day flying can be called successful in a broad sense. As it is, he has had no superior in the development of aviation; for he made contributions to the fundamental science of aerodynamics; made numerous models propelled, first by rudder, then by steam, then by gasoline; and finally produced a full scale machine that can carry a man as it was designed to do. When finally the aeroplane shall become an important agency in the civil and serious business of the world, who will be called its inventor? Langley's work will, doubtless, rank level with the best that has yet been done in the world of aviation.

X-Ray Analysis of Crystals

By John W. N. Sullivan.

TWENTY-FIVE years ago Lord Rayleigh discovered that the brilliant coloration of crystals of chlorate of potash when white light falls on them is due to selective reflection. From all the rays of different wavelengths which constitute white light the crystals select rays of certain wave-lengths, within very narrow limits, for reflection. This effect is due, as Lord Rayleigh showed, to the existence of regularly spaced twinning planes in the crystal parallel to the reflecting surface, and he illustrated the effect by reflecting a high-pitched note by a series of parallel muslin sheets stretched tight and evenly spaced.

At the present time, using X-rays instead of white light, investigations are being made on the actual arrangement of the atoms in various crystals, by observing the manner in which they reflect X-rays from their various faces.

A pencil of X-rays of uniform quality is reflected from a face of a crystal when, and only when, it meets that face at the proper angle of incidence. There is a certain relation connecting the wave-length of the X-radiation, the proper angle of incidence, and the spacing of the planes in which the atoms of the crystal are arranged, which planes are regularly spaced and parallel to the face of the crystal.

It is evident that by observing the correct angles of incidence for reflection at the various crystalline faces for the same pencil of X-rays, and deducing therefrom the different spacings of the atomic planes parallel to each face, we can, by analyzing these results, deduce the actual distribution of the atoms throughout the crystal, and even build models illustrating the atomic constitution.

For these experiments we require a homogeneous pencil of X-rays, and bulbs having rhodium or palladium antikathodes are very suitable, as they last well, their line spectra are very intense, and the wave-lengths are of convenient magnitude. The exactness of the reflection effect is such that the two constituents of the principal rhodium line, which is really double, are just separated by reflection at the cleavage face of the diamond.

A crystal is considered to be made up of groups of atoms. Each group is supposed to contain as few atoms as possible consistent with the requirement that the whole crystal may be built up by packing all these groups together, the groups in any one crystal being similar and similarly oriented.

If now we choose any point in a group as characteristic of that group, then by choosing corresponding points in every other group in the crystal we get an assemblage of points which indicates the relative position of any one group with respect to any other group in the crystal. The assemblage of points obtained in this way is known as a "space lattice" and is of fundamental importance in considering the basal structure of a crystal.

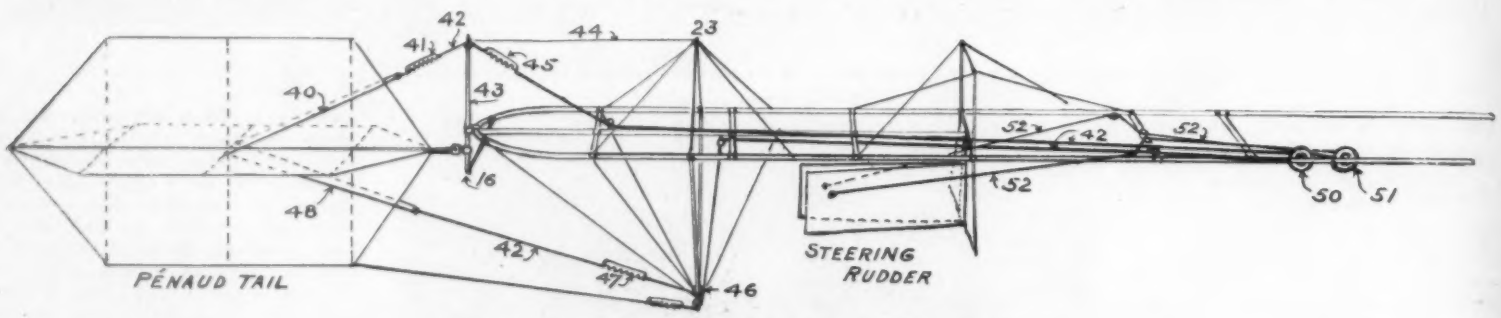
The large class of crystals known as cubic crystals are the simplest in construction and, considered with reference to their space lattices, they fall into three divisions.

In the first division, which is called the cubic, the representative points for each group are placed at the corners of a cube, the whole lattice consisting in a repetition of this arrangement in all directions in space. In the second division, the centered cubic division, there are representative points at the corners of a cube and at the center of the cube. The third division, known as the face centered cubic, is characterized by having its representative points at the corners of a cube and at the middle points of the faces. By building a model we see at once that the relative spacings of the planes in these three divisions are different, and this causes corresponding differences in the angles of reflection of some standard line, when using the X-ray method of analysis; so that these three types of lattice may be at once distinguished from one another.

We now come to a case of great importance. Sodium chloride and potassium chloride have long been known to be of similar construction, although until quite recently the precise nature of the construction has not been known. By using the X-ray method of analysis, however, we find that the sodium chloride crystal has the characteristics of the third class of lattice, and the potassium chloride crystal of the first type of lattice. In addition, it appears that the elementary group, or pattern, contains the same number of atoms in each case. Prof. Bragg explains these facts as follows: "Suppose that we place chlorine atoms at the corners of a cube and at the centers of the faces and sodium atoms at the middle points of the edges of the cube and at the cube center, and take this to represent the structure of sodium chloride. Potassium chloride may be derived from sodium chloride by replacing the chlorine atoms of the structure by potassium. Now, it appears from a number of mutually supporting indications that the contribution of an atom to the reflection effect depends on its atomic weight only. The atoms of potassium and chlorine are of very nearly the same weight, and can be looked on as equivalent. If this is done, the structure of potassium chloride is, in effect, the simple cubic. But there is a great difference between the weight of sodium and chlorine, and the face-centered arrangement of the chlorine atoms taken separately gives its character to the whole sodium chloride structure. All this agrees with experiment. But there is more. The presence of the sodium atoms among the chlorine, arranged, as a matter of fact, on a face-centered lattice of their own, modify the purely face-centered character of the spectra, and experiment shows that the modification is exactly such as theory predicts."

The simple crystals have been analyzed and the structure of many of the more important cubic crystals is known. The complex structure of the calcite series has been determined, and something has been discovered of the still more difficult structures of sulphur and quartz. In each of these cases we require to determine not only the lattice, but the arrangement of the atoms in the group which is represented by each point on the lattice.

Among cubic crystals, one of the most interesting is the diamond. The carbon atoms are arranged in a most beautifully symmetrical pattern, each being at the center of a regular tetrahedron composed of its four nearest neighbors. Rings of six carbon atoms form a predominating feature. Planes perpendicular to a cube diagonal are arranged in a curious way, the spacings



Stabilizing and steering mechanism of the Langley aerodrome.

To maintain equilibrium Langley relied mainly on the use of the Pénaud tail. The combined Pénaud tail and rudder controls the longitudinal equilibrium by movement in the vertical plane under the combined influence of its initial negative angle and the elasticity of its connection with the frame, the flight being kept as nearly as possible in a straight line, by the vertical surfaces of the tail. The tail swings up and down by reason of its pin connection with the vertical tube 16. The bridle 40, connected with the center of the tail on its upper side, passes upward, where it is connected with the spring 41, which in turn is connected with a single wire rope 42, passing over a pulley mounted on the top of the post 43, guyed to the upper side post by the wire 44. After passing over the pulley the wire rope 42 is connected with the spring 45, around the two ends of which it forms a loop, and from there it passes down to the plane of the main frame, and through suitable blocks to the aviator's control wheel 50, convenient to the right hand. The wire from this point passes through various pulley blocks toward the rear of the machine and through the pulley block 46 mounted on the side near the bottom of the rear lower guide post. At a short distance beyond this pulley it is connected with a weaker spring 47, the other end of which is connected by a second bridle 48, with the under side of the Pénaud tail. The control wheel can be automatically locked in any position in which it may be when the aviator removes his hand from it. For rising or descending the aviator can swing the Pénaud tail from its extreme upper position to its extreme lower position by a small motion of his hand. The control of the steering rudder is effected by a steering wheel 51, a continuous cord 52, passing from the steering wheel through suitable pulleys to either side of the steering rudder.

being alternately large and small, in the proportion of three to one.

Zincblende has exactly the same structure as the diamond, but the alternate planes of the kind just mentioned contain, alternately, zinc atoms alone and sulphur atoms alone.

Iron pyrites has a rather more complicated structure, which explains at once the curious disposition of the striations on its faces, while sulphur has eight interpenetrating lattices, quartz three of silicon and six of oxygen. In the last two cases the lattices are regularly spaced along the long axis, but not in other directions.

The atoms of a crystal are, of course, in movement to an extent which depends upon the thermal state of the crystal, the motion increasing as the temperature rises. According to theory, this must tend to destroy the intensity of the spectra, particularly those of a higher order, a deduction which is confirmed by experiment. The angles of reflection diminish and the spacings of the planes increase as the crystal expands by heat, which suggests a method for measuring the coefficients of expansion of crystals.

But, besides the light thrown upon the structure of crystals by the X-ray method of analysis, valuable information is afforded us respecting the X-rays themselves.

In the *Proceedings* of the Royal Society for last year Prof. Bragg has shown that by the reflected X-rays a method may be derived for the spectroscopic study of the X-rays.

Using an ionization method, he has measured the intensity of the rays reflected at certain angles by the crystalline faces, and showed that the distribution of these intensities gave evidence of a series of maxima and minima, which gives a first approximation to the distribution of energy in the spectrum considered as a function of the wave-length.

A Close Shave in the Air

WITH only a few flying machines in the world and the whole ocean of air to fly in, one would think a collision of aeroplanes to be next to impossible. And yet more than one of such accidents have occurred, and the results were, of course, disastrous. Certainly there would seem to be less excuse for an encounter in the three-dimensional space of the aeroplane's domain than in the two-dimensional planes of travel that land and sea vehicles must adhere to. The aerial pilot may leap over or dive under his adversary; and yet with no fixed lanes of travel it is evident that much confusion is liable to arise, particularly as flying machines are very fast and there is no system of signaling between them.

At the recent aviation meet at Heliopolis, a collision between two aeroplanes was so very narrowly averted as to send thrills of horror through the spectators. In this case the proximity of the aeroplanes was due to the fact that they were rounding a pylon and were trying to hug the course as closely as possible. There were three aviators in the air, Guillaux, Chevillard, and Olivier. Suddenly Guillaux was seen to approach Chevillard, and it looked as though he would surely strike the right wing of Chevillard's biplane as it was banking for the turn. By the barest margin the monoplane cleared the biplane, and the two aviators continued their flight, undaunted by their harrowing experience.

By rare good fortune one of the correspondents of *L'Illustration* happened to catch the two aeroplanes with his camera at the very moment when the collision seemed imminent. We have used this remarkable photograph, by courtesy of *L'Illustration*, for our cover illustration. It shows by what a small margin a serious accident was averted. It is the first photograph ever taken of an aerial encounter. In the distance may be seen the biplane of Olivier.

Scientific and Animated Gyrostats

AT the recent Conversazione of the Royal Society, Dr. J. G. Gray exhibited gyrostats with accessories and a series of what may be called "animated" gyrostats. These latter consist of gyrostatic acrobats, bicycle riders, and gyrostatic motor cars, both two-wheeled and four-wheeled. The models exhibit Dr. Gray's methods of endowing gyrostatic devices, mounted on moving bodies, with complete stability. The devices, so mounted, are available for directing and forcibly maneuvering the bodies. One of the two-wheeled cars is provided with a gyrostatic "chauffeur," which stabilizes the car and presides at the steering wheel. This car illustrates the action of directing and stabilizing apparatus for use on torpedoes, airships, and aeroplanes. A further form of two-wheeled car demonstrates methods of stabilizing and maneuvering an airship by means of forces derived from the propellers, which apply a direct push to the moving body. Dr. Gray's bicycles and motor cars can be steered by the wireless transmission of electrical action.

The Discovery of Nebular Rotation

By V. M. Slipher, Lowell Observatory

BEYOND the solar system the astronomer is concerned with two kinds of objects, stars and nebulæ. That these are related by some general process of evolution has long been thought. Laplace's celebrated nebular hypothesis is an attempt to outline how an extended nebula might evolve through contraction under the force of gravitation into a star like our sun and be surrounded by planets in consequence of the nebula's rotating during the process. This was, as he pointed out, speculative, but Sir William Herschel's epoch-making observations of nebulæ in various degrees of condensation led him to a like theory. Herschel found graduations in nebulæ from the most diffuse to those scarcely distinguishable from real stars.

During the last thirty years the spectroscope and the photographic plate have added vastly to our knowledge of both stars and nebulæ. And there have come to light so many hints of an evolutional process running through and connecting these bodies, that we are to-day using many descriptive terms which tentatively assume an orderly evolution. Finding this law is the problem that faces the astronomer to-day, and now, as in the days of Swedenborg, the geologist wants the answer, that he may the better know the earth's past and future.

In the investigation of the spectra of the celestial bodies we to-day use the spectrograph, a photographic spectroscope, which receives the light through a very narrow window or slit, adjusted into the focus of the telescope. After entering the slit the light passes through a lens to prepare it for the prism, which next receives it and passes it on, refracted and dispersed, into its component colors, to the camera. Here the light falls on a photographic plate. In the telescope, stars are always bright points of light, planets bright disks,

Nebular rotation shown by inclined lines in its spectrogram.

nebulæ faint patches of various shapes and sizes. Thus if the telescope be directed on a star the spectrum will be a very thin band; if on Jupiter, a broad band, running through the colors from red to violet, but interrupted by the numerous spectral lines. It is these spectral lines—always different for different substances—that tell us of the presence of the chemical elements in the stars and nebulæ, and also of their motions; for, if approaching us, the lines are all shifted toward the violet end of the spectrum; if receding, toward the red, the amount of the shift telling how rapidly. A terrestrial spectrum is always photographed beside the celestial spectrum, to enable us to make all desirable comparisons and measures. On such a spectrum photograph of Jupiter, made with the slit on his polar diameter, the Jovian lines will cross the spectrum band at right angles, as do the comparison lines; but if the slit be placed on the equator of Jupiter, then his lines will be inclined in consequence of his diurnal rotation, which causes one edge of his disk to approach us and the other to recede. By measuring the inclination of the lines, the length of the planet's day can be deduced.

It was the application of this method, made at Flagstaff a few years ago, which showed the length of the day of Uranus, previously unknown, to be about ten and one half hours.

These methods, known for twenty years, have only recently been applied to the nebulæ. The reason for this delay in so studying the nebulæ with the spectrograph is doubtless due to the faintness of their spectra. The slit can receive light from only a thin line of the already faint nebular image, and the prism disperses it into a spectrum that is so faint as to require not only hours, but nights and even weeks, of exposure before the most rapid photographic plate will give a useful negative.

Spectrum photographs of an interesting nebula in the constellation of Virgo, catalogued as N. G. C. 4594, made with an especially efficient spectrograph attached to the 24-inch refracting telescope, show the nebular lines unmistakably inclined, and therefore prove the nebula to be rotating about an axis. This nebula may be seen in the accompanying illustration from a direct photograph made with the 40-inch reflecting telescope of this observatory by Mr. C. O. Lampland. The elongation of the nebula is east and west. The slit of the spectograph was placed over this long axis, which would show the axis of rotation to be nearly north and south. It doubtless rotates about the central condensation, from which it seems to extend into a more or less disk-like mass which appears spindle-shaped, because we must look against its edge. If Laplace could have seen this nebula as it really is, he might have found in it a satisfactory illustration of his nebular hypothesis.

While it has long been thought that the nebulæ rotate, this actual observation of the rotation was almost as unexpected as the discovery that this and other similar nebulæ have enormously higher velocities than do the stars. The discovery of the rotation of this nebula has opened a new field for investigation, which can hardly fail to throw some light on the important subject of stellar and nebular evolution.

The American Radio Relay League

THE American Radio Relay League has been organized in Hartford from the Radio Club of Hartford, a group of wireless enthusiasts and experimenters. This league is intended to organize and link together the best amateur wireless stations in the United States and Canada. According to our information, there are some 300,000 of the amateur wireless telegraph stations in existence and actually receiving and transmitting messages at the present time. It only remains to link the best of these together in order to make it possible for an amateur in Maine to communicate with an amateur in California.

Already the league is transmitting from Hartford, Conn., to Buffalo, N. Y., through Northampton, Mass., and Westfield, N. J. Certain hours in the evening are prearranged, and these messages are relayed through by courtesy. With conditions favorable, a message is sent through to Buffalo, delivered, and the answer received back within the hour.

Up to the advent of wireless telegraphy, and its popular use by the lay public, the only way to transmit intelligence was by the assistance of the telegraph or telephone companies, or else the postal facilities of the Federal Government. The popular adoption of wireless telegraphy makes it possible for the private citizen to bridge distances without the aid of either the big corporations or the Government.

Amateur wireless operators are requested to communicate with the Radio Club of Hartford and secure blank forms, which, when filled out, are used for appointing the official relay stations.

The Wanamaker Transatlantic Machine

IT is announced that the Rodman Wanamaker transatlantic machine which Glenn H. Curtiss is building at Hammondsport will soon be ready for its first trials. It is stated that the machine is almost ready to be assembled. The motors were recently subjected to a 30-hour continuous run. There are two of them, each of 100 horse-power. Originally it was intended to use a single motor of 200 horse-power, but Lieut. Porte advised that two well-tried stock motors should be used instead of a single large experimental power plant. It is said that the Wanamaker machine is not as large as originally intended. Its length is only thirty feet.

The Current Supplement

IN this week's issue, No. 2007, of our SUPPLEMENT, Dr. F. H. Hatch gives a review of current theories of ore genesis.—The reduction gear and dynamometer of the United States steamship "Neptune" is described in detail.—S. Chapman writes on the number of stars and the light received from them.—An important paper which should be read by all is Dr. W. W. Keen's "The Influence of Antivivisection on Character."—A rapid system of water filtration on a large scale is described and illustrated.—J. Boyer contributes an article on pneumatic grain elevators.

Wright Flying Licenses

IT is announced that the owners of aeroplanes which infringe the Wright patents must pay a fee of $1,000 to the Wright Company and, in addition, $25 for each day or part of a day that the machine is operated or exhibited for profit or prize. The license expires on December 31st. Aviation meetings are by no means as popular as they were five years ago. It is not likely that professional aviators will therefore eagerly accept the Wright conditions.

Mistletoe thrives on the Western coasts to an extent not approached in the East. In many places this parasitic growth is responsible, directly or indirectly, for a considerable loss of timber.

The Super-dreadnought "Queen Elizabeth"

The First Battleship to Mount 15-inch Guns

By Oscar Parkes

THE battleship "Queen Elizabeth," and her sister ships, "Warspite," "Valiant," "Barham," and "Malaya," mark the commencement of a new era in British naval construction, being the first ships to carry the new 15-inch gun—a weapon which discharges a projectile of 1,950 pounds weight against the 1,400 pounds of the 14-inch and latest 13.5-inch guns. In addition, they will be the first ships other than scouts and torpedo craft to be driven solely by oil-fuel, and with their speed of 25 knots—which is likely to be greatly exceeded on trial—will have the distinction of being the fastest battleships afloat.

Although officially designated "battleships," the "Queen Elizabeth" class are becoming looked upon as "battle-cruisers" from the fact that their speed is four knots in excess of the standard speed for line ships and obviously intended for overhauling the enemy's rear-guard and forcing an action—the generally accepted rôle of the battle-cruiser. In later ships a return has been made to the usual speed of 21 knots, the "Royal Sovereign" class which are now under construction having the same armament as the "Queen Elizabeth," but on something like 2,000 tons less displacement—the decrease being accounted for by the drop in speed, and the saving in machinery weight, engine room, and therefore dimensions.

The adoption of the 15-inch gun is, of course, typical of the British policy, which is "superiority both in numbers and individual power." It would have been simpler to have met foreign ships armed with ten or more 14-inch guns by the construction of similar ships, but equality does not postulate annihilation, and this is what will probably be the fate of the "Queen Elizabeth's" opponents. British gunnery experts do not, however, favor the placing of more than ten big guns in a ship, and even had the Admiralty been anxious to retain the very successful 13.5-inch gun which has appeared in the "Orion," "King George," and "Iron Duke" types, their reply to say the "Pennsylvania" would have been a ship with ten of these pieces—twelve or fourteen such guns would have been more than can be adequately controlled, according to British practice. Eight guns being the ideal group, it becomes obvious that the only way out of the difficulty of providing a better and more powerfully armed ship lay in increasing the caliber of the guns—hence the advent of the 15-inch and the probable early reappearance of the 16.25-inch gun when the smaller weapon becomes generally adopted elsewhere.

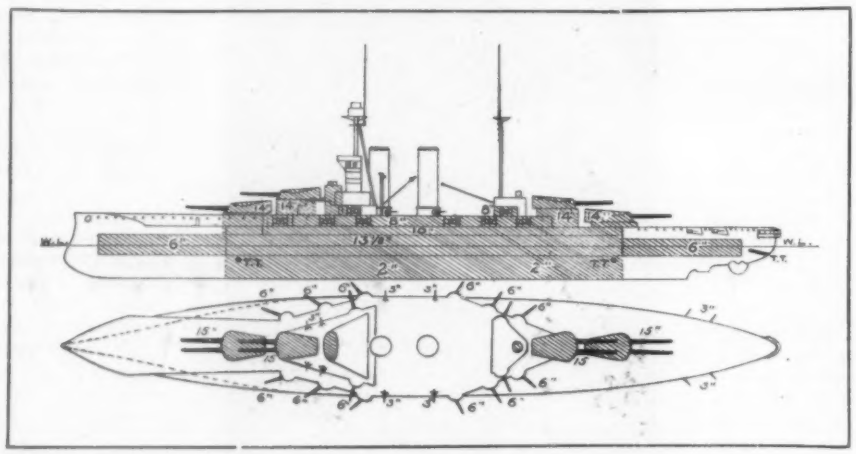
In appearance the new ships will be very much like the "Iron Duke" class, with the amidships turret suppressed and an extra mast aft, instead of the stump between the funnels, which is such an unsightly feature of these vessels. There is the usual pile of chart houses and bridges forward, the heavy tripod mast with a double-storied control-top, big funnels, and torpedo net defense. The big guns are in four 14-inch turrets along the center line, the third and fourth superfiring axially. In casemates in the superstructures and along the upper deck are spaced the sixteen 6-inch rapid-fire guns, while eight 3-inch anti-aero guns are distributed over the upper works, and four more are carried at the stern of the ship. There are five torpedo tubes (21-inch), two on each side and one in the stern, all below water.

The dimensions of the "Queen Elizabeth" are: Length, 650 feet over all; beam, 94 feet, and draught, 27½ feet, giving a displacement of 27,500 tons.

For water-line protection there is a 13½-inch belt extending from the base of the foremost turret to just short of the aftermost, with 6-inch continuations to within about 20 feet of the extremities. Above is a 10-inch strake along the lower deck side amidships with 8-inch over the battery, the gun positions in the superstructures being similarly protected. Amidships the hull is covered with thin armor—two or three inches, probably—down to the keel, and a most elaborate system of internal under-water protection reinforces this. The thickness of the armor decks and bulkheads is uncertain.

The great speed has only been attained by the substitution of oil fuel for coal, and a supply of 4,000 tons of this can be stored. With Parsons turbines generating 58,000 nominal horse-power and driving four screws, the designed speed is 25 knots.

Of the five ships, only the name ship and the "Warspite" have as yet been launched (March), and these two are due for completion in October; the remaining three should join the flag between Spring and Summer, 1915. At present afloat the only ships which can compare with them in fighting power are the "Texas" and "Oklahoma" classes, with the Japanese "Kongo," the Chilian "Al. Latorre," and the Turkish "Rechadieh."



Outboard profile and deck plan of super-dreadnought "Queen Elizabeth," showing guns and armor plate.

Note under-water protection against torpedoes.

Psychophysical Tests for Falsehood

By Dr. Anton Rose

FALSEHOOD, when practised by an expert, is not easily detected by the most careful scrutiny of the liar's appearance and manner, but extraordinary and successful means for its detection have been developed from the study of experimental psychology. The principal psychophysical factors employed in this method are the character and rapidity of the mental process known as association of ideas. The word "horse," for example, may suggest anything related to horses—a stable, a familiar breed, a characteristic color, such as bay or chestnut, a race track, etc.

In criminal jurisprudence this fact is utilized by uttering a word and requiring the suspected person to say, instantly, what the word suggests to him. The test is repeated with a great number of words, some of which, introduced in an apparently casual manner, bear directly on the crime and relate to facts which only the criminal knows. If the suspect is really guilty he is pretty sure to betray himself unconsciously. Even if he is cautious enough to modify the first response that occurs to him, he betrays himself by the slight delay thus caused, for the abnormally long interval between question and answer (which is measured to a fraction of a second) shows that he has taken time for consideration, at a point of danger.

A simpler and more objective test has recently been adopted. This test is based on the intimate relation which has been proved to exist between mental processes and the pulse and respiration. Several years ago, for example, Prof. Stoërring, of Bonn, found that feelings of pleasure and its opposite produce well-defined changes in respiration. Prof. Benussi of Graz has discovered that analogous effects are caused by lying. Cards imprinted with various letters, figures, and diagrams were distributed among a class of students, each of whom was required to give a truthful description of the card given to him, unless the card was marked with a red star, in which case its recipient was required to describe it incorrectly. In either case he was watched attentively by his fellow students who, ignorant of the nature of the card, tried to guess from his manner whether he was lying or telling the truth. The observers made many mistakes, pronouncing false statements true, and conversely—a result which confirms the statement made above in regard to the difficulty of detecting falsehood by the speaker's manner and appearance.

Respiratory tests, however, gave unerring and unequivocal results. The time occupied in inspiration and in expiration was measured immediately before and after each card test, and it was found that the utterance of a false statement always increased, and the utterance of a true statement diminished, the quotient obtained by dividing the time of inspiration by the time of expiration.

The importance and scope of this discovery are obvious, for it furnishes a certain and objective criterion between truth and falsehood. Even when a clever liar endeavors to escape detection by breathing irregularly he is likely to fail in the attempt, for Benussi has investigated such cases and found that voluntary changes in respiration do not alter the result.—Abstracted from *Die Umschau*.

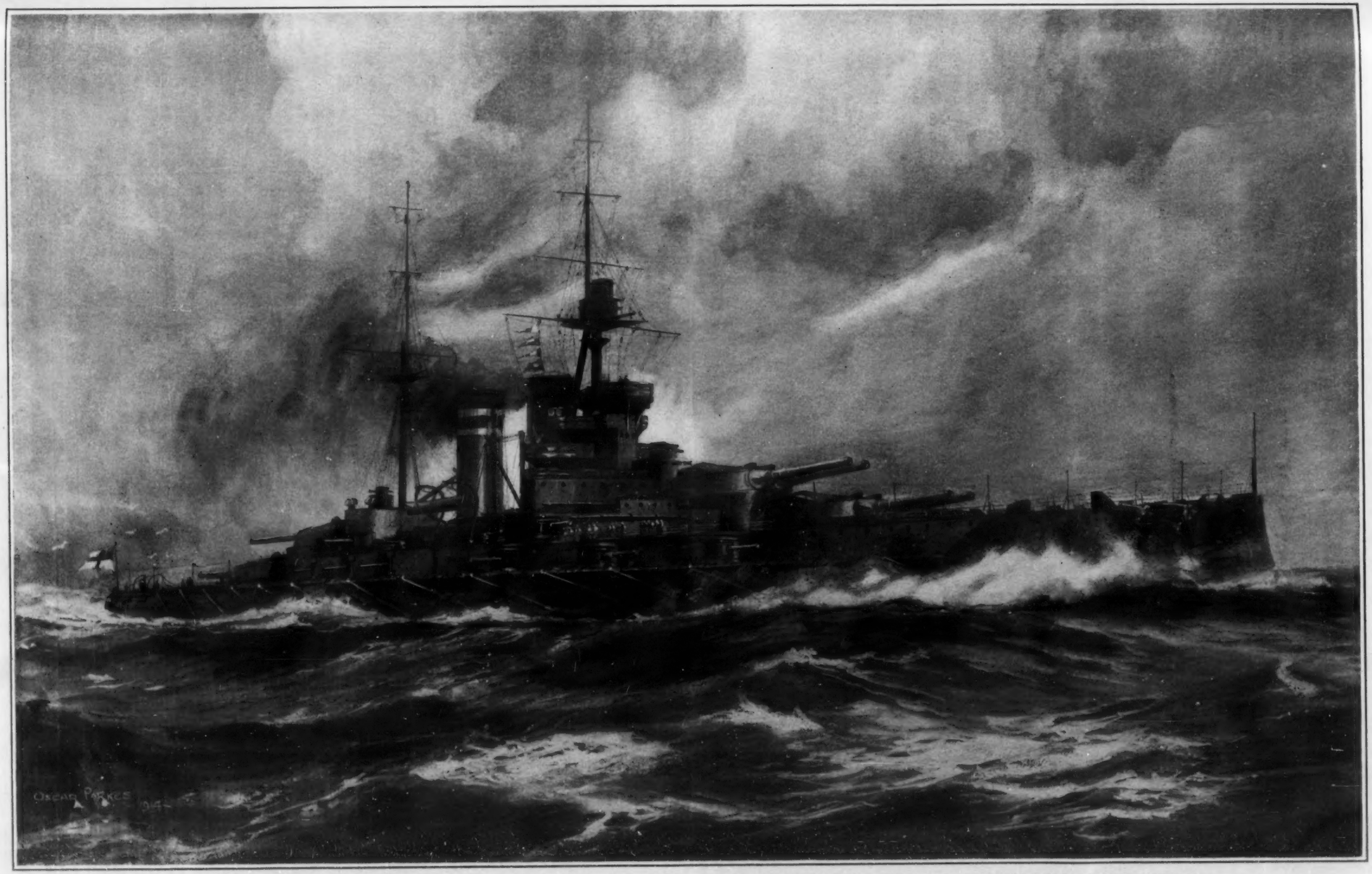
The Hawaiian Volcano Observatory

THE Hawaiian Volcano Observatory grew out of a lecture delivered at Honolulu in 1909 by Prof. T. A. Jaggar, Jr., of the Massachusetts Institute of Technology. The interest aroused by this lecture led a number of prominent citizens of Hawaii to subscribe funds toward founding an observatory on Kilauea, but the project remained dormant until the Summer of 1911, when the Institute of Technology sent an expedition to Hawaii under F. A. Perret, who was accompanied by Dr. Shepherd of the Carnegie Geophysical Laboratory, as a high temperature expert. The remarkable investigations carried out by this expedition, including measurements of the temperature of liquid lava, revived interest in the plan of founding an observatory, and in October, 1911, the Hawaiian Volcano Research Association was organized in Hawaii and Massachusetts. This association has provided funds for the erection and maintenance of the observatory, while the scientific work is directed by the Massachusetts Institute of Technology. Prof. Jaggar has been director of the observatory since July, 1912. The observatory issues a weekly bulletin, as well as a more elaborate semi-annual report. The Whitney Laboratory of Seismology is a branch of the work, fostered through an endowment fund presented to the Institute of Technology in 1909 by the Whitney estate of Boston. In the brief period since the observatory was established it has become a Mecca for the vulcanologists of the world, and its facilities are placed freely at the disposal of scientific visitors. Dr. Arnold Heim of the University of Zürich made a remarkable series of photographs here in 1912 for publication in Dr. Stille's "Geologische Charakterbilder." Last Winter the Hawaiian Volcano Research Association sent Prof. Jaggar to Japan to study the eruption of Sakurajima.

Rat Exterminators in England

IMPROVEMENTS in one direction invariably lead to other improvements either incidental or additional. The United States Consul at Sheffield, England, tells of the attempts made to exterminate the rats infesting the steel works and large stores of that city, and goes on to say that an opportunity will shortly occur in Sheffield to demonstrate the value of American rat exterminators. What is known as the killing shambles and the fish and meat market, located right in the center of the city, are to be pulled down in accordance with the new town planning scheme of the city authorities. When this does occur, it is recognized by the public that the homes of millions of rats will be destroyed, and articles and letters appearing in the local newspapers recently urged the corporation to do something to prevent the migration of this vermin.

Elastic Celluloid Varnish may be made as follows: Cut one ounce of celluloid into fine shreds. Add to a solution of ten ounces of acetone and ten ounces of amyl acetate and stir it well. Do not wait for it to dissolve. Cork tightly and set in a warm place. To make a thicker varnish add more celluloid, but a thin varnish is most elastic. To secure colors add aniline dyes dissolved in a little alcohol to the acetone solution.



Displacement, 27,500 tons. **Speed,** 25 knots. **Armor,** waterline belt, 13½-inch; middle belt, 10-inch; upper belt, 8-inch; under-water belt, 2-inch. **Guns,** eight 15-inch, sixteen 6-inch; twelve 3-inch anti-aeroplane guns.

The British super-dreadnought "Queen Elizabeth."

An Electric Brake for Automobiles

AUTOMOBILES are growing more and more electrical every day, although their chief motive power is gasoline. We have now electric lights, electric horns, electric starters, and electric gear shifters. The latest electrical appliance for the automobile is the electric brake.

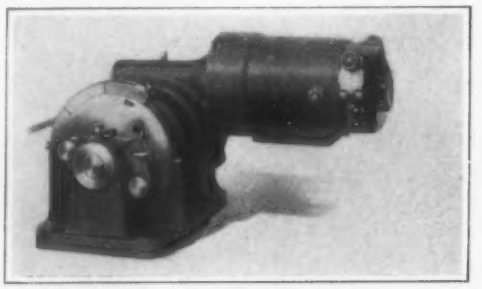
About two years ago we described an electric starter in which a small motor of very high speed was used to turn the engine over. The motor was far smaller than would be required to do the work if it were connected directly to the crankshaft of the engine. Indeed, a gearing of 250 to 1 was interposed, permitting the motor and a flywheel it carried to acquire such a momentum in a brief interval as to carry the pistons over beyond the compression point.

This same principle is now being used to operate the emergency brake of an automobile. It has the advantage that the driver of the car does not have to lean over, as in the present system, and feel around for a brake lever while keeping his eye on the road and endeavoring to steer his machine with one hand, but needs, merely, to operate a small hand lever right on his steering wheel. The brakes may be applied to any degree of pressure desired. When the wheel is absolutely locked a friction clutch comes into play, which prevents breakage of the parts. No resistance is introduced in the motor circuit, but the current is admitted to it directly. Because the operation is momentary, there is no danger of burning out the motor, even though it be greatly overloaded.

The accompanying drawings show the details of construction. The motor shown at *A* drives a worm-wheel *B*. This in turn, through friction wheel *C* and gearing *D*, *E*, drives the shaft *F*. On shaft *F* is a ratchet wheel *G* adapted to be engaged by pawls mounted on the winding drum *H*. A cable from this drum runs to the emergency brake. Mounted on the cable drum *H* is a friction stop *J*, adapted to come into contact with the fixed stops on the casing when the brakes have been drawn up to the locked position. This prevents further turning of the drum and consequent breakage of the cable. By regulating the frictional contact of the stop *J* with the drum *H*, the desired maximum tension on the brake cable may be adjusted to a nicety.

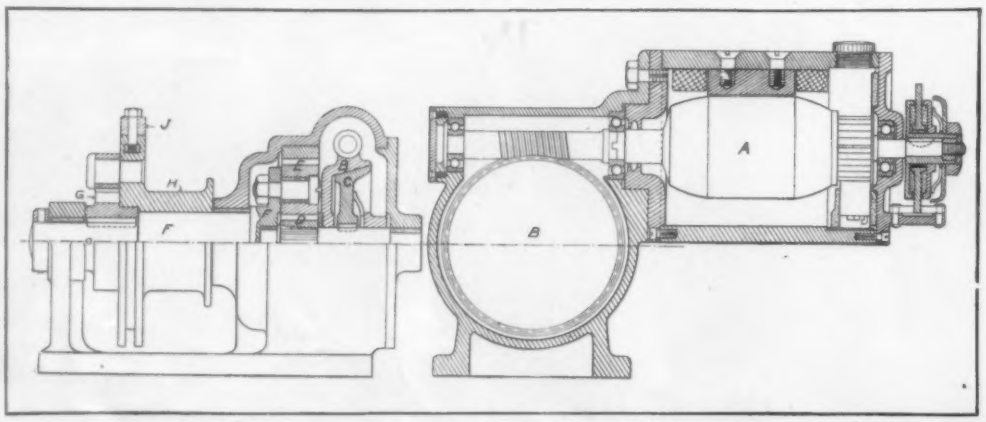
Every time the brake lever is touched to admit current to the motor, the armature of the motor speeds up to an enormous speed, which is transmitted through step-down gearing to the brake drum, causing it to wind up the brake cable. By successive momentary operations of the brake lever, the drum may be made to wind up its cable with a step-by-step movement until the required pressure on the brakes has been attained. Or, in case of emergency, the lever may be thrown on full, when the brakes will lock the wheel almost instantly. The brake bands are preferably oiled, so as to cushion the action of this brake. To release the brake, the brake lever is moved to reverse position. In place of the cumbersome controller shown in the photograph of the machine, a simple double throw switch has been devised with an automatic snap release, to prevent sparking. The current used by the brake motor is no more than is used by an electric horn.

So convenient is this brake that no doubt it will be used in place of the ordinary foot brake. It is interesting to note that an electric brake of this type is being tested now on a street railway car in this city.



Emergency brake lever on the steering wheel.

The brake motor and drum.



Step-down gearing between the motor and winding drum.

The Thalassioscope

By Dr. Alfred Gradenwitz

DR. AURELIO DE GASPARIS, of Naples University, has devised an ingenious apparatus for the study of organisms at the sea bottom, which, thanks to its high magnifying power, enables all phenomena of submarine life to be watched from a considerable distance. The "thalassioscope," as the apparatus is called, will keep the image constantly in focus, thus allowing even the swiftest movements of marine animals to be followed without shifting it. Its remarkable simplicity of construction reduces absorption due to refraction to a minimum.

The apparatus comprises a floating stage on which the observer is seated, and which, by means of paddles, can be moved in any direction. At the foot of this floating stage there is fixed a wide tube about four feet long and twelve inches in diameter, carrying a spur at the end. In this wide tube there moves another smaller one, to the upper part of which a large lens of about ten-foot focus is applied.

The outer tube is, moreover, provided with a binocular optical system about three feet long, comprising two lenses of about six and one half foot focus. This tube is inclined at an angle of about 45 degrees, and carries in its upper part a photographic camera and a folding protective hood for the observer's head. While the thalassioscope floats along the surface of the water, the observer, looking through the tube, may see an unwonted spectacle. He may fancy himself gliding along the bottom of the sea, any impression from the outside world vanishing completely. Beds of beautiful *Floridæ*, red, violet, and purple, shining in a multitude of vivid colors, may be seen side by side with dark brown and blackish *Fucaceæ* and *Laminariæ*, which at times assume the shape of a fan, and again look like so many undulating ribbons, and which sometimes are massed together in bushes forming veritable forests. After the plains come valleys, and after these, abysses, in whose unfathomable depths swarms of fishes pass to and fro. Strange forms, of which you cannot distinguish either shape or color, dazzle the eyes by their rapid and seemingly disorderly movements. The rocks are covered by myriads of gay-colored creatures, blended by degrees in the blue chasm, and finally disappearing altogether in unknown depths.

The thalassioscope as it appears when in use.

The spectator has the same impression as a diver, but for his feeling perfectly safe from the dangers of the sea bottom and far removed from its deathly silence, which so often strikes the diver with terror.

Since everything is highly magnified, the observer is in a position to note such details as would be lost completely to the naked eye; the floating cage affords an excellent vantage ground for studying at his ease the secrets of marine biology, his specimens living in their natural element where their movements are not hampered in any way, as is, e. g., the case in an aquarium.

Can England Be Attacked from the Air?

THE possibility of an aerial attack upon England and other matters relating to aerial warfare were discussed at a recent meeting of the Royal United Service Institution. Col. Jackson read a paper upon defense of localities against such attacks, referring in the first place to the fleets which Germany and France will likely possess in three years, and this he thinks will be no less than forty or fifty airships of high power and an almost unlimited range, carrying a 50-ton load and traveling at an average of 60 miles an hour. No doubt the range of airships will be 1,500 miles before long. He then points out the danger of an unexpected attack upon England, and considers that the airship is far from being on the decline, or at least will not be so until armored aeroplanes prevail. Even then the airship will have manifold uses for supply of armies or transport of wounded. Soon the aeroplane will be armored so as to resist fire, and mounted by two or three men it will become indispensable in all army operations. Aeroplanes should have a machine gun on board, or a small cannon of the Pom-pom type, which had some success at Transvaal, and was recommended by the French General Langlois. At least a bomb-dropping device is needed, but he considers that a good one is not devised as yet. Then considering an attack on Great Britain—and this also applies to other places—he thinks that many points would be exposed to an attack in three years or so, but destruction of fortified places is not much to be feared, for each of these will possess defensive means. Airships hardly fly higher than 5,000 feet, so that they will be a good target for the guns. But serious damage could happen by dropping bombs upon other places, such as towns, army storehouses and factories, oil and gasoline stores, wireless telegraphy posts, and especially railroads and trains. However effective a preventive attack may be during the day, it will be difficult for aeroplanes to keep track of airships at night and prevent them from dropping bombs upon large cities such as London. He hopes that the Geneva convention as to attacks upon unfortified places would be respected, but there is no certainty about this in time of actual war, as recent experience shows, and besides, such rules did not include aircraft, so that they need to be revised. In case of bomb-dropping at night, it would be almost impossible for an aeroplane fleet to work against an airship, for the aeroplanes need some light in order to be able to steer, to see their position and to land, while the airship can sail almost without noise and without light. Only an airship fleet would be a sufficient means of defense in that case, hence the need of a sufficient fleet appears to be evident.

Pennsylvania has about seven and one half million acres of timberland, one eighth of which is owned by the State. The total value of the State's timber is 139 million dollars.

Making Money Out of Butterflies

By Robert H. Moulton

Ready for a butterfly hunt with poison bottle and net.

A wonderful group of migrating monarch butterflies.

Catching moths with bottle and lamp on a sugared cloth.

XIMENA McGLASHAN of Truckee, California, last Summer first began catching and preparing butterflies and moths for the scientific market. She was but eighteen years of age; she had no previous instruction in the work; she had no capital; her apparatus was home-made: she averaged for the season fifty dollars a week.

These combinations seem remarkable. But almost as remarkable is the fact that, though Miss McGlashan's case is exceptional, it need not be so. This successful young money-maker states that there are ten thousand places where butterflies and moths may be sold, and, of course, there are ten thousand times ten thousand localities in the United States where the insects may be snared. Every locality has its special varieties; hence, the eager demand from a market that can never be glutted, never, even, be satisfied. The butterfly business, or to speak more accurately, butterfly farming, for the raising of the winged beauties also constitutes a very important part of the industry, is open to every man, woman or child who has access to woods, meadow or back lot where butterflies are wont to gather. Few but the scientifically trained are in the business, not because a knowledge of entomology, or the science of insects, is required, but for the reason that scientific men, as a rule, being close-mouthed, are not inclined to let the public into their affairs very intimately.

The first season's work netted her $520. Twenty thousand eggs, larvæ (or caterpillars) and pupæ (larvæ in the cocoon stage) of butterflies and moths were also stored away for the Winter, a "stock" with which to make a magnificent start in the Spring.

The original apparatus was as follows: Several wide-mouthed bottles, each containing a small quantity of cyanide, in a leather case to be strapped to the shoulder; a few paper boxes; a butterfly net; a pair of delicate forceps. Cyanide may be bought in cake form at 50 or 60 cents a pound. A piece of No. 9 wire, a light bamboo rod, a few cents' worth of gauze, and there is the net. Forceps are to be had for 50 cents the pair. Not much capital required for a start in so lucrative a business, was there? With this simple equipment she sallied forth upon her first conquest of the butterfly hosts. Cyanide is both a deadly poison and a harmless anæsthetic—harmless to the butterflies, at any rate, if they are not permitted to remain corked up with it for more than ten minutes. Each specimen Miss McGlashan captured she promptly transferred to the bottle, the quicker the better, so as not to permit it to injure itself by its struggles to escape through the gauze. As she worked, every few minutes she carefully sorted over her catch. Males of the commoner species in perfect condition she let perish, with the purpose of disposing of them in the market at once. Only the absolutely perfect specimens will sell. Dealers can never be imposd upon; their eyes are far sharper than those of any amateur. No half-rates for slipshod work: it is perfection or nothing that is demanded in this business. Those males slightly bruised or with wings battered, were reserved for breeding purposes, as were females. Miss McGlashan had already arranged with a dealer to take her mounted specimens at a flat rate of 5 cents each. From the very first, therefore, she began to make money.

Feeding female moths and butterflies while they are laying eggs in boxes and paper bags.

Feeding larvæ confined in bottles, jars, boxes, and barrels.

The processes, if intelligently studied, are relatively simple, deft touch and painstaking care being the chief requisites. Cork-lined boxes, cork linoleum, which, by the way, is a good deal the cheaper and every bit as good, or insect cork may be used to secure the cyanide-asphyxiated insects safely for shipment. For this purpose special pins, which sell at $1.25 per thousand, or less in larger lots, must be used. Any other sort of pins won't do at all. They are not fine enough, and will utterly spoil the thorax of the insects through which they should always be put in mounting. Another pair of forceps larger than the ones used in ordinary handling of the butterfly or moth must be employed, to take hold of the pin from beneath the insect and force the point firmly down into the bed of cork. If fingers should so much as even slightly brush or touch a specimen, the chances are pretty certain that it is irrevocably ruined. One fact, a very important one, too, must be strictly borne in mind by the shipper: he should be certain the dealer who has agreed to make purchases of him is fair and reliable. Miss McGlashan's prisons for her captives probably were the least expensive part of her inexpensive equipment. These were the little paper boxes previously mentioned. As she sorted her booty of the meadows she transferred each of the living to its separate box. These little box prisons were but temporary. On the captives being taken home, other arrangements for keeping them had to be made. Of course, the purpose in preserving the females alive is to secure eggs and, ultimately, more butterflies. This method naturally enables the butterfly farmer to obtain a much larger and more perfect "crop" than he would otherwise. But it is rather difficult to induce the female to lay unless conditions are entirely satisfactory, though moths are not at all particular in this respect. Most butterflies in captivity prefer to lay their eggs in gauze bags; all insist that a piece of their special

(Concluded on page 511.)

Hearing Ourselves as Others Hear Us

IT is a well-known and frequently observed fact that many singers and performers on musical instruments exhibit a degree of complacent satisfaction with their own efforts, which is not at all commensurate with the amount of pleasure they have given their audience. But the exaggerated view they form of the musical value of their achievements is not entirely due to that vanity to which our poor human nature is so prone. They do not, as a matter of fact, hear themselves as others hear them. This is particularly the case with a singer. A singer produces and hears a note at the same time, the sound being conveyed through the Eustachian tube of the ear. The *external sound*, the sound heard by the audience, is not, in the ordinary way, heard by the singer at all.

How to hear yourself play the piano and sing.

Mr. Donald McHardy, a voice specialist of many years standing, has invented an apparatus to obviate this disadvantage under which all singers and instrumentalists have hitherto labored. The apparatus is extremely simple, and consists of a half-sphere made of metal, connected to a long flexible, metallic tube. The tube terminates in two branches, the ends of which fit in either ear. The sound produced by the performer, after impinging on the open half-sphere, travels down the metallic tube to the performer's ears. The sound heard by the performer in this way corresponds exactly to the effect produced on an audience.

Although so simple, the apparatus in its present form is the outcome of a good deal of experiment. Various-shaped openings for the metal receiver have been tried, but the half-sphere opening is the only one which gives satisfactory results. Various materials have been employed in the construction of the connecting tube, with the result that the metal at present employed has been found to possess distinct advantages. As was to be expected, it was found that a rubber tube gave very poor results.

The present writer took the opportunity of playing a piano solo to a small audience, first with and then without the apparatus, and the audience were unanimous in declaring that the second performance was distinctly better, although to the writer they sounded identical.

"Marble Light"

By Our Berlin Correspondent

IT has been known for a long time that marble in very thin sheets is translucent, and that colored marble sheets give the most striking effects. A German engineer, Mr. Hermann W. Engel, of Hamburg, by a special polishing and impregnating process, has, however, succeeded in endowing marble slabs of considerable thickness (1/10 to 3/4 inch) with a transparency far superior to that of opal glass. After being polished on both sides, these marble sheets are impregnated with diverse oils, at high temperatures, under heavy pressure. This process is not only less costly than preparing plates only a few thousandths of an inch in thickness, but insures far greater stability. The color effects of such marble slabs, on account of the greater thickness, are much more beautiful than in the case of the thin layers. Skylights of colored marble have been provided aboard some German steamers, and, when lighted at night, by electric incandescent lamps, produce effects of remarkable beauty.

Some most interesting tests have been made by Dr. Voege at the Hamburg State Laboratory, which go to show that light passing through this marble possesses many striking qualities, and is equally commendable for economic and hygienic reasons.

From comparative tests on opal glass and impregnated marble plates, respectively, it is seen that the latter possess far greater transparency. Moreover, they are lighted uniformly up to the edges, and when inspected side by side with opal glass, appear perfectly white. Impregnated marble is especially efficient if an electric lamp arranged within a reflecting box be used as the source of light, which source can be closed by a marble slab or milk-glass plate. Whereas the former only absorbs about 20 per cent of the total radiation, the latter, in fact, holds back as much as 40 per cent. In spite of its greater transparency, marble is fully equal to milk-glass, as far as its power of absorption is concerned. The most striking feature of marble light, however, is its remarkable softness and pleasing effect.

A device whereby the players of wind instruments can sustain tones indefinitely.

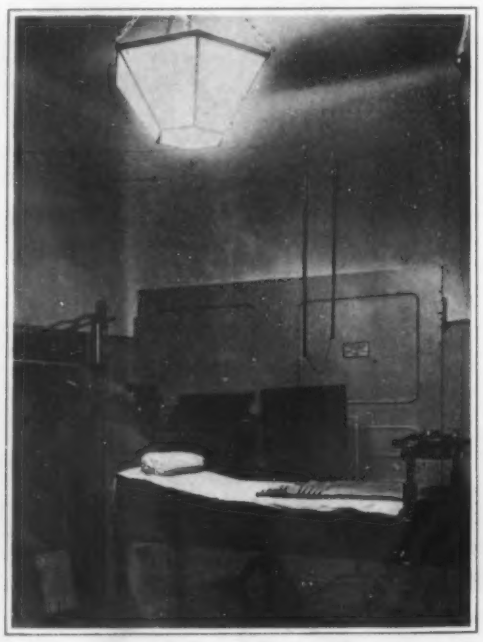
The central picture shows the course of the air-current from the mouth-piece of device *A*, at the corner of mouth, around the structure of the mouth to the mouth-piece of instrument *B*, at the center of lips. At the moment of the player's intake of breath through the nostrils *C*, the entrance to the lungs from the mouth is automatically closed by the pressure of the base of the tongue *F* against the soft palate *D*. The stop-valve on the device *E* prevents the re-entrance of air into the tubing of the device once it has entered the mouth; therefore, the only outlet for the air is by the natural course, cleaving to the roof of the mouth *G*, striking the soft palate *D*, and working backward along the surface of the tongue *F* to the mouth-piece of the instrument *B*. Meanwhile the air admitted to the player's lungs enters only by way of the nostrils *C*. He may even breathe out through the nostrils and still indefinitely sustain the tone of the instrument by the air-current which the pedally-operated bellows supplies. That air-current is warmed and moistened to the degree of the human breath by an incandescent bulb and immediately adjacent water-chamber contained within the bellows structure.

Artificial Lungs for Bandsmen

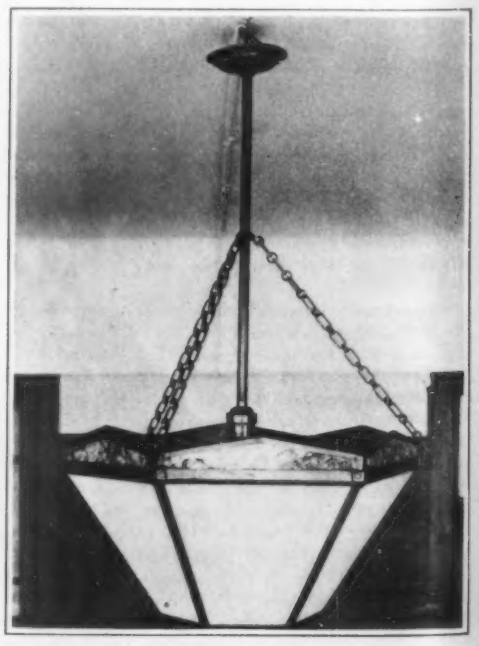
By Harry Chapin Plummer

TO provide an efficient physical means for fulfilling the superhuman demands imposed upon wind instrumentalists by the great symphonic and operatic scores of Richard Strauss, Wagner, Brahms, d'Indy, and the modern school, a new tone-sustaining apparatus has been devised by Bernard Samuels, a native of Paramaribo, Dutch Guiana, who is at present first flutist of the Royal Opera at Schwerin, in Germany, and chamber musician to the Grand Duke of Mecklenburg-Schwerin. The new device consists of a foot-bellows having a water-chamber with incandescent bulb and a length of rubber tubing fitted with a stop-valve and mouth-piece, all simply attached, for the convenience of the player, to the instrument that is being played, but in no sense forming a part of the instrument. By means of the water-chamber and electric-light bulb, the air forced through

Smoking-room of an ocean steamship, in which marble light is employed.



An operating-room illuminated with marble light. The light is remarkably soft.



A marble light electrolier. The marble sheets cut off a large percentage of the dark heat rays.

by gentle pressure of the foot upon the bellows is both warmed and moistened to about the degree of the human breath, and is transmitted to the mouth by the rubber tubing. It enters through the mouthpiece at the corner of the mouth and, performing the natural circuit of the mouth, passes out through the mouthpiece of the instrument, at the center of the mouth. So, when the performer is drawing breath through the nostrils, the current of air started by his foot sustains the tone upon which he is engaged. It will matter little whether that tone be a single note or an elaborate cadenza—the pressure of the bellows will sustain it indefinitely, if desired. Although the air from the bellows is carried into the mouth, the stop-valve within the tubing prevents the entrance of any air into the bellows.

Composers will now be afforded a well-nigh unlimited scope in writing for brass and reed instruments. Already Richard Strauss has specifically designated the device in more than one passage of his "Festival Prelude."

The device is now well established in the principal symphony and opera orchestras. The Royal Opera of Berlin, of which Dr. Strauss is the director, was one of the first representative institutions to have the entire brass contingent of its orchestra equipped with the apparatus.

Just what aid the device renders to important musical performances may be judged from the fact that it was employed in the recent rendition of the "Nibelung Ring" cycle of music-dramas by Wagner at the Metropolitan Opera House, and it was the first occasion at that theater when the full strength of the horns could be employed in certain passages simultaneously. In the prelude to "Das Rheingold," for example, the tubas are called upon to hold a tone for ninety bars. Until now this has been a physical impossibility for the individual player, who has had to take breath after every three or four bars. Now, however, all the players can sustain the tone for the full ninety bars. Similarly, in the "Dragon music" of "Siegfried," the tuba will be able to sound its stentorian and raucous bass tones without having to chop and break the phrases, as hitherto.

James T. Allen

ON May 26th James T. Allen died at Washington, D. C., from a complication of troubles. He was a veteran examiner in the Patent Office, having been appointed September 18th, 1868, from the Twenty-sixth Congressional District of New York, making his service nearly forty-six years in length. He was a careful and conscientious worker, with a wide acquaintance and friendship among patent attorneys. During his service he compiled digests of plows, seeders, and planters, harrows, grain drills, and air and gas engines, and for a time edited monthly periodicals relating to these digests. These publications were in wide demand, many having gone to Germany and other European countries. For forty years he had charge of the important class of seeders and planters, and served the Government and inventors with entire satisfaction.

Decisions on Patents

THE Jenner patent, 804,726, for a candy-pulling machine has had its claim 1 held invalid and its claims 7 and 8 valid and infringed in Hildreth v. Lauer & Suter Company; and in the same case the Dickerson patent, 831,501, for a candy-pulling machine has had its claim 1 held valid and infringed and claim 2 valid but not infringed. In Lewis Blind-Stitch Machine Company v. Arbeter Felling Machine Company, the Lewis patent, 862,830, for a blind-stitch sewing machine has been held valid but not infringed. The Lane design patent, 37,501, for a design for a piano case, has been held valid and infringed in Bush & Lane Piano Company v. Becker Brothers. The Parsons patent, 723,299, for pneumatic tire armor, has been held valid and infringed in Parsons Non-skid Company v. E. J. Willis Company. In Crown Cork and Seal Company of Baltimore City v. Sterling Cork and Seal Company, the Painter patent, 638,354, for a machine for automatically sealing bottles, has been held not infringed, while the Painter and Hawkins patent, 643,973, for an apparatus for feeding crowns to a bottle-sealing machine, has been construed and is limited, held not infringed.

Notes for Inventors

A Self-Threading Shuttle.—A. Meunier of Taunton, Mass., in patent No. 1,093,713 presents a self-threading construction of shuttle which does not result in an objectionable weakening of the shuttle and can be readily applied to or embodied in shuttles now in use.

A Mail-Collecting System.—Samuel C. Cox of Washington, D. C., has patented an improvement in mail collecting in which the collecting vehicle co-operates with the mail box. The mail is delivered directly from the box into the receptacle of the vehicle without intermediate handling.

The Label and the Laundry.—Joseph French of Woonsocket, R. I., has secured patent No. 1,093,985 for a label-attaching improvement in which the label is fastened temporarily to the article by a thread which, while it holds the label to the article during the required treatment, can be easily withdrawn to detach the label.

Electric Lamps to Indicate Liquid Level.—Patent No. 1,093,745 has been issued to John A. Turner of Washington, D. C., in which the level of liquid in a tank is indicated electrically through the aid of a vertical series of lamps whose individual circuits are opened and closed by the rise and fall of the water in the tank, thus showing visually the level of the water in the tank.

A Re-Winder for Music Sheets.—Patent No. 1,093,813 was issued to Frank C. White of Meriden, Conn., assignor to Wilcox & White of same place for an improvement in music playing instruments, having for its object to stop the forward travel of the note sheet at the end of the composition, re-wind the sheet on its spool and to finally stop the machine when the sheet is fully re-wound.

Secret Photograph as an Aid to Subsequent Identification.—In patent No. 1,094,073 Alfred Ilg of Zürich, Switzerland, provides for photographing a person without his knowledge. He time stamps and dates the photograph so it may be subsequently used for identifying the person. The invention is especially adapted for use by police and pawnbrokers.

The Water-proofing of Concrete.—Richard K. Mead of Roland Park, Md., in patent No. 1,092,933 has patented a process and concrete composition wherein waterproof qualities are imparted to cement by adding to the cement a powdered filler whose particles are oil-coated so that when made into concrete or the like it will be impervious to water.

Using Paper to Indicate Broken Rails.—In patent No. 1,092,986 Joseph H. Gardside of Philadelphia, Pa., provides strips of paper attached to railroad rails throughout their lengths. These strips will be broken by a passing train if the rail be defective and thus plainly indicate to the track-walker the defects in the rail.

An Elihu Thomson Turbo Ship-Steadying Patent.—Elihu Thomson of Swampscott, Mass., assignor to General Electric Company, in patent No. 1,093,159 utilizes the rotating parts of the turbo generator as a great gyroscope to steady the ship and reduce her rolling, the turbo generator having a vertical shaft.

Protecting the Hat from Rain.—Christina Mullaney of New York city has patented an emergency covering for hats, which cover is made of waterproof paper and can be secured to the hat by the customary hat pins employed to hold the hat on the head.

Preventing the Splitting of Railway Ties.—A method of preserving railway ties has been patented in No. 1,093,230 to William E. Williams of Chicago, Ill. The tie is compressed and a metal band is secured tightly around the tie at the compressed places with a view to preventing the checks and splints induced by the spikes and the slowly developed splits and cracks resulting from the traffic.

Two Moving-Picture Apparatus Patents.—Adolph F. Gall of West Orange, N. J., assignor to New Jersey Patent Company of West Orange, has secured patents Nos. 1,092,905 and 1,092,906, the first providing a screen and operating means therefor for protecting the moving-picture film from the heat emanating from the projecting lamp, while the second patent controls the passage of light through a projection aperture of the lamp house in such manner as to insure the closing of the projection aperture of the device when the latter is in any position except the projecting one, and will uncover the aperture when the device is moved into a projecting position.

A Patent to Tom Johnson.—Margaret J. Johnson, as administratrix of Tom L. Johnson, deceased, of Cleveland, Ohio, has secured patent No. 1,090,213 for a high-speed railway in which a stationary element along which the truck is movable has a portion above the truck and means for creating both a tractive and lifting effect on the truck by which a magnetic field is created which passes between the stationary element of the truck and such field is distorted in the direction that the truck is adapted to move.

Two Patents to Charles Francis Jenkins.—Charles Francis Jenkins, the well-known inventor of Washington, D. C., has secured patent No. 1,089,645 for an aeroplane engine in which a closed crankcase has opposite depressions, receiving cylinders, and is revolubly mounted upon a fixed axial crankshaft, piston structures passing through openings in the crankcase with an aeroplane propeller carried by and rotating with the crankcase. He has also secured patent No. 1,089,646 for a motion-picture camera in which a lens moves in an endless path and carries with it a portion of a film, which portion is exposed while the lens moves through a portion of its path, the movement of the lens through another portion of its path bringing a fresh portion of a film into its axis.

Preparing Mail Matter for Posting.—Patent No. 1,090,499 to John W. Poller of Takoma Park, Md., assignor to Molyneux Mailing Machine Company of Buffalo, N. Y., is for a machine which folds up a sheet of paper in flat form, removes an envelope from a pack of envelopes, inserts the sheet of paper in such envelope after opening and positioning the envelope, suitable means being provided for directing the sheet into the open envelope.

Correcting the Drawings of Patent Applications.—An order has recently been issued by the U. S. Patent Office, having for its purpose to stop the constant mutilation of the Office records. Hereafter corrections and alterations of the drawings of pending patent applications will be made only by the draftsmen employed by the Patent Office, a reasonable charge to be made by the chief draftsman for such corrections as may be necessary.

A Charles Steinmetz Patent.—In patent No. 1,088,740 to the General Electric Company as assignee of Charles P. Steinmetz, there is presented a method of producing an arc in a transparent chamber between terminals, one of which is vaporizable at low temperature and the arc being colored by the addition of a chemically active metallic substance while the enclosing chamber is protected from injury by neutralizing the chemical activity of the metallic substance.

A Motor Field Structure which Operates as a Pulley.—Ethelbert M. Frazer of Yonkers, N. Y., has patented an electric motor particularly adapted for use in connection with a tractor elevator. The motor has a stationary armature and a rotatable wheel structure which is encircled by the armature and is so constructed that it can be used as a pulley to operate a flexible driving connector.

Legal Notes

New Combination of Old Elements.—In United Gas Improvement Company v. Gas Machine Company, Fed. Rep. 211-672, the court has held that a new combination of old elements, which, by their co-operative action, produce a more beneficial result, amounts to invention, which is not negatived by the fact that such co-operation requires the mediation of an operator. Also in the same case it was held that where a patent contains description of only one form of a thing which will perform the same office in other forms, the court will apply the general rule that the description covers all equivalent forms and the form described will be treated only as the one preferred.

New Use of Old Material.—In O'Brien-Worthern Company v. Stempel, Circuit Judge Sanborn said: "But the application of an old device to a new one is not always or generally even patentable. It is only when the new use is so recondite and remote from that to which the old device has been applied or for which it was conceived that its application to the new use would not occur to the mind of the ordinary mechanic skilled in the art that there is invention in the conception of its application to the new use, and the old use fails to limit the claim of such an application." Along the same line Circuit Judge Lacombe in Archer et al. v. Imperial Machine Company, said: "Sometimes it is true a change of material will produce a novel and unexpected result which might evidence invention."

Supreme Court Decision on Ten-Year Clause Trade-Marks.—Some interesting matters are included in the decision of the Supreme Court of the United States, the opinion being rendered by Mr. Justice Hughes, in the case of Thaddeus Davids Company v. Davids & Davids, trading as Davids Manufacturing Company. The registered trade-mark was the surname "Davids," registration being secured under the provisions of the ten-year clause of the act. The court said that as the mark consists of an ordinary surname, it was not the subject of exclusive appropriation as a common-law trade-mark, and the applicant who by virtue of actual and exclusive use is entitled to register his mark under this clause (the ten-year clause) becomes on due registration the "owner" of a "trade-mark."

Some Adjudicated Patents.—In the Ney Manufacturing Company v. G. A. Swineford Company, the Taylor patent No. 486,812 for a track for hay carriers has as to claim 1 been held void as covering a broad combination of which the patentee never claimed under oath to be the originator or the inventor, and the Anderson and Holstein patent No. 683,425 for process of making fabric-covered ornaments was held not infringed in Holstein v. Seeland Ornamental Company; the Rhodes patent No. 777,488 for a fish bait or lure was held valid and infringed in William Shakespeare, Jr. v. Enterprize Manufacturing Company, and the Carter patent No. 777,714 for a culvert was held not infringed in Carter v. Burch Plough Works Company. The Niez reissue patent No. 13,163 (original 916,361) for a disk harrow was held valid and infringed in Bucher & Gibbs Plow Company v. International Harvester Company.

The Term of Design Patents.—Heretofore it has been the practice to hold applicants for design patents to the election of term, whether three and a half or seven years, specified in the application, but Commissioner Ewing has with the approval of the Secretary of the Interior amended the Patent Office Rule of Practice to permit the applicant who may in his application request the issue of the patent for one of the shorter terms to amend his application at any time before the allowance of the application, upon the payment of an additional Government fee, and to request the issue of the patent for the longer term, so that if the application originally elects a term of three and a half years or seven years, the applicant may extend the term to seven years or to fourteen years as may be desired.

RECENTLY PATENTED INVENTIONS

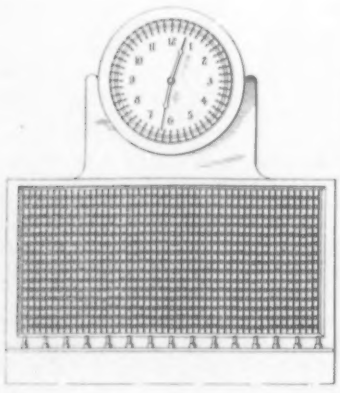
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

NECKBAND FOR SHIRTS.—J. H. FUNK, 546 W. 156th St., New York. The invention provides a neckband cut so as to have an overlapping end portion for thickening the band at the end carrying the button, so as to prevent pressure of the button against the neck. The design of the neckband is such as to reduce the movements in the manufacture thereof to a minimum, and at the same time provide button guards both at the top and back.

Electrical Devices.

ANNUNCIATOR SYSTEM.—T. A. HAUGAARD, care of B. and B. Dept., U. P. R. R., Cheyenne, Wyo. To do away with the use of a "call sheet" by hotel clerks whose failure to record the desired call or to make the call after entering it, has led to much distress and loss of time to travelers, Mr. Haugaard has invented



AUTOMATIC CALL SYSTEM FOR GUESTS OF HOTELS.

this system, in which the traveler may see for himself that the plug is in the annunciator, when he may be assured that he will be awakened at the desired time. Its capacity is unlimited and it can be installed without much expense beyond that of installing the ordinary annunciators.

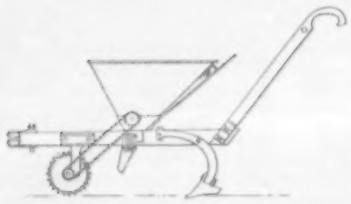
CONNECTING CLIP FOR ELECTRICAL CONDUCTORS.—J. G. ELKIN, care of Elk Manufacturing Co., 68-72 E. 131st St., New York. The clip here illustrated may be securely fastened to insulating conductor wire, enabling it to be quickly and conveniently attached to or detached from a binding post or the like. It

CONNECTING CLIP FOR ELECTRICAL CONDUCTORS.

consists of a pair of spring-pressed jaws pivotally connected and a clamp on the pivots of the jaws, adapted to engage the bare end of the wire conductor, this clamp consisting of a hollow screw with tapered bore adjustable upon tapered clamping members, thereby providing a quick-action gripping of the wire.

Of Interest to Farmers.

REVERSIBLE FERTILIZER DISTRIBUTOR.—J. W. GUNTER and G. P. HAARDT, Box 36, Montgomery, Ala. The object of the invention here illustrated is to provide a device which is reversible, so that the drive-wheel may be



REVERSIBLE FERTILIZER DISTRIBUTOR.

placed either at the front or at the rear of the plow blade, thereby permitting the fertilizer to be deposited and plowed under, or to be placed in the furrow and covered by the follower. The device is provided with a feed which may be regulated as desired. Means are provided for agitating the fertilizer and for forcing it toward the feed opening.

FENCE STAY.—J. A. NICKOLAUS, R. F. D. No. 3, Mount Pleasant, Iowa. The fence stay consists of a single strand of wire so formed as to provide an anchoring element at one end, which may be readily and quickly secured in position in connection with an erected fence, in order to support efficiently those wires between the posts of the fence, which are otherwise likely to sag.

TRACTION ENGINE.—F. HECKMAN, Maria Stein, Ohio. The traction engine has two traction wheels on a divided axle connected by differential gearing and driven by an internal combustion engine. Normally the traction engine has no rear wheels, as it is adapted to be coupled to the wagon or agricultural implement that is to be hauled. However, means are provided for supporting the rear of the tractor on supplementary rear wheels, if so desired.

SWIVEL CONNECTOR.—G. W. OAKES, care of Pittsburgh Plate Glass Co., Crystal City, Mo. This invention relates generally to swivel connectors adapted to be placed in electrical conductors in order to prevent tangling of the conductors in moving about apparatus to which they are attached. It consists of a pair of swivel terminal members to which the conductors are connected and about which there is a casing of insulating material.

MAGNETO.—W. CASEY AND I. LESSES, 384 Brock St., Kingston, Ontario, Can. Exposed wiring is done away with in this magneto and the mechanism is made waterproof. The high-tension conductors are short, thereby lessening the chances of grounds and short-circuits. The parts are so arranged that the current is delivered at maximum intensity over a long range.

ELECTRIC HORN SWITCH.—J. E. FOULKS, Jr., 1324 Dean St., Brooklyn, N. Y. In order to permit of turning on the electric current to an automobile horn or siren without removing the operator's hand from the steering wheel, the present invention provides a switch in the form of a ring secured to the steering wheel. By pressing the ring toward the wheel, at any point, one or more contacts are made, closing the circuit of the electric horn.

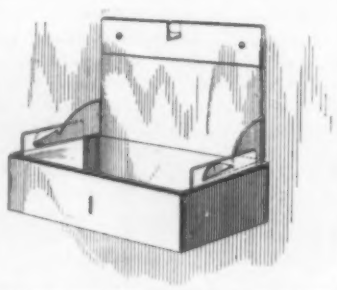
HOUSING FOR ELECTROMAGNETS.—E. GEGENBACH, care of Duplex Electric Co., 514 W. 57th St., New York. The invention relates particularly to ironclad housings for electromagnets, which will not only provide greater protection for the winding of the electromagnet, but also greater efficiency of operation. The housings are made of sheet metal bent to suitable form, with certain portions co-operating with the armatures of the electromagnets.

Of General Interest.

ENVELOPE.—G. SCHNITZLER, 109 Amerman Ave., Arverne, N. Y. The principal objects of this invention are: To provide an envelope having a tearing section reinforced to provide a uniting member, the structure of which is unbroken; to provide means for preventing the introduction within the tearing area of the letter or enclosure when deposited in the envelope, and to provide means of the character mentioned readily and cheaply applicable to envelopes constructed in accordance with the present invention.

CLEANING METAL SURFACES.—C. H. THOMPSON, Harrington House, Ambiecote, Stourbridge, England. The process consists in placing articles without metallic connection with the electrodes in a bath of any suitable chlorid, sulfate, or nitrate solution, preventing the articles from contacting with the electrodes, arranging said articles in series with each other and the electrodes, and passing an alternating-current through the bath, the current, by this arrangement of articles and electrodes, passing through the articles in succession.

MATCHBOX.—H. W. GASKILL, Columbus, New Mexico. The device here illustrated consists of a box containing matches, which is so constructed that it may be used as a match



MATCH BOX CONVERTIBLE INTO A MATCH HOLDER.

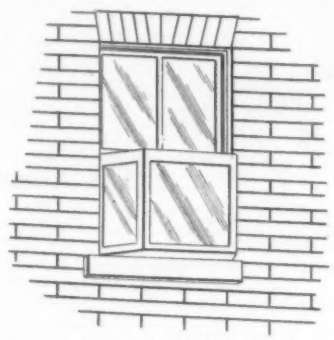
safe or holder. The top of the box may be extended and secured to a wall, while braces are provided for securing the body of the box at right angles to the top portion.

ERASER HOLDER.—C. E. MOON, Box 972, Oxnard, Cal. Among the objects of the present invention are: To provide a simple, inexpensive, and strong eraser holder which is neat in appearance, has no projecting portions which will interfere when it is placed in a pocket, which can be easily placed on a pencil or removed from it, and which will permit the consumption of substantially the entire eraser.

PLASTIC COMPOSITION.—J. E. BECK, Sunnyvale, Cal. This plastic composition is adapted to be used in lieu of ordinary plaster walls and ceilings, or for flooring, pavements, plaster boards, shoe leather, trunks, suitcases, drums, barrels, boxes, etc. It consists of straw digested in lye, and subsequently pulped, mixed with flour, zinc chlorid, and coloring matter.

BOTTLE GUARD.—O. WIDEMANN, Box 97, Douglas, District of Alaska. The invention relates to non-refillable bottles and provides means for preventing the insertion of a tool or implement. This means consists in a web that runs across the neck of the bottle with an opening in the web and a downwardly-extending arched cap over the opening. A V-shaped rib forms a further obstruction to the introduction of a tool.

WINDOW.—J. R. BOILEAU, Minocqua, Wis. The invention provides means capable of being applied to an ordinary window to convert it into an extension or bow window, so as to permit the occupant of a room to see laterally as well as directly outward. The device may be



AN EXTENSIBLE BOW WINDOW.

inclosed by a perforated covering in warm weather, to prevent the entrance of insects, dust, and the like, or with an imperforate, transparent covering, in Winter, to prevent the entrance of cold air, without obstructing the view.

UMBRELLA.—C. SCHMIDT and A. HIRSCHWITZ, 1342 St. Bernard Ave., New Orleans, La. The invention has for its object a provision of simple and inexpensive means for connecting the ribs and stretchers of the umbrella to the stick in such manner that they may be easily detached and removed for the purpose of repairing, without necessitating the removal of the cover or disassembling the elements of the umbrella.

PROCESS FOR MOLDING PLATES.—A. J. JARMAN, care of J. J. Travers, 45 Brittam Ave., Elmhurst, Long Island, N. Y. The object of the invention is to produce an inexpensive light and reliable molding plate for half-tone or line work in typographic or intaglio printing, which plate will receive all the impressions of a suitable matrix, no matter how fine, without warping, and give a good hold to the printing ink.

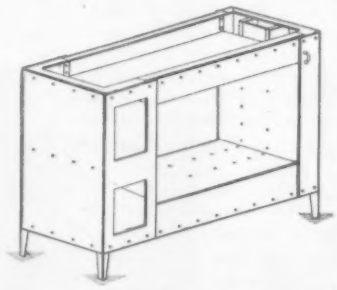
FURNACE DOOR OR CLOSURE.—J. B. PHILLIPS and J. A. KAPLAN, 523 Avington Ave., Zanesville, Ohio. This invention relates to the doors or closures of smelting furnaces where exceedingly high heat is generated. As heretofore constructed these doors are apt to burn out frequently. Accordingly, the present invention provides an all-refractory closure, consisting of a single slab of firebrick or the like with a novel holder constituting a gripping and suspending means for the refractory closure.

Hardware and Tools.

BOLT AND NUT LOCK.—D. D. TULLOCH, 296 Market Street, Newark, N. J. The invention provides an improved bolt and nut lock in which a bolt of uniform dimensions with respect to the standard size bolt used, is designed for co-operation with a nut of special design in that it is increased in thickness and counterbored to receive a plug attached to the bolt and forming means to lock the nut to the bolt against rotation.

Heating and Lighting.

TAKE-DOWN COOK RANGE.—G. N. FRAZER, Eugene, Oregon. The present invention, which is an improvement on a previous take-down cook range invented by Mr. Frazer, consists of four sections, namely a firebox section, a



TAKE-DOWN COOK RANGE.

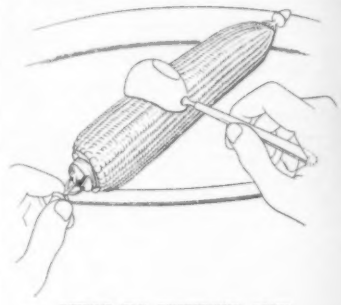
flue section opposite to and facing the firebox section and intermediate upper and lower sections. All four sections may be readily and quickly assembled and taken apart, and when free from one another may be conveniently stored in a minimum space.

HEATING APPARATUS.—J. MCGUIRE, Savannah, Ga. The furnace has heating chambers connected by pipes with a delivery flue for delivering the heated air to the desired place and a draught pipe passing through the chambers and extending into the flue to produce a suction therein, and consequently in the heating chambers, to draw the heated air out of them and into the flue.

GAS TUBE COUPLING.—G. K. HOFF, Decatur and Walker Sts., Holmesburg, Pa. The invention relates to a flexible gas tube for conducting gas from a gas bracket to a gas lamp or stove. It provides an improved coupler arranged for convenient attachment to the gas nipple without danger of becoming accidentally detached.

Household Utilities.

CORN BUTTERER.—H. M. PRATT, 66 Beaver St. (Room 504), New York, N. Y. The invention relates to tableware, and has for its object to provide a device for evenly spread-

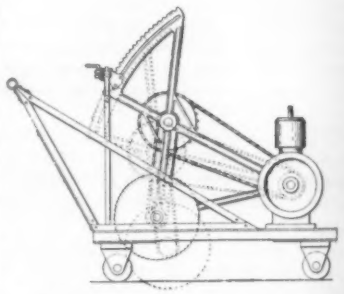


DEVICE FOR BUTTERING CORN.

ing butter on an ear of corn. The device consists of a handled bowl adapted to contain butter and a concave perforated cover adapted to fit upon the peripheral face of an ear of corn.

Machines and Mechanical Devices.

MACHINE FOR CUTTING PAVING.—GREGORY PERKINS, 505 West 21st St., Los Angeles, Cal. Mr. Perkins' present invention relates to a machine for cutting asphalt and other paving through the use of a power driven circular saw, his object being to provide a machine, including means by which to sup-



MACHINE FOR CUTTING PAVING.

port a circular saw in such manner that it may be adjusted toward and away from the ground and held in selected position for cutting the paving or other material to a desired depth.

BOBBIN-STOP.—C. NORDELL, Gilbertville, Mass. The invention provides a means for stopping the bobbin when "piecing up." The bobbin is mounted upon a shell which has frictional engagements with a rubber clutch member engaging the driving pulley. To stop the bobbin the shell is raised out of engagement with the clutch by means of a lever, and is stopped by frictional engagement with a fixed yoke.

THREAD-CUTTER.—J. A. DOWD, Box 411, Fall River, Mass. This thread cutter is adapted to cut threads on pipes and form spaced threaded portions. The cutter is provided with a threaded peripheral surface with the thread or spurs at different distances from the center of the cutter so as to cut straight or tapering threads on the tube or bar in a continuous operation.

DRILL.—J. T. CURNOW, Palatka, Mich. The principal objects of this invention are to provide means for clearing a drill hole while drilling, to introduce a water jet for washing the hole and cooling the drill point, to utilize the power applied to the drill for water-jetting the drill hole and to provide means for controlling the supply of water to the hole.

AMALGAMATOR.—S. BEER, Greenwood, Cal. The invention provides a device within the means of the private miner, although capable of embodiment in apparatus of large size, for the treatment of gravels to recover the "rusty" gold formerly lost, owing to the formation of rust on the gold bearing material which resisted the amalgamating action in the operation of the ordinary apparatus.

APPARATUS FOR MANUFACTURE OF OBJECTS FROM PLASTIC SUBSTANCES.—O. EBERHARD, Heidenau, near Dresden, Germany. The apparatus relates to the manufacture of soap, sweets, and the like in which a number of diversely colored streams are forced through a die to unite them into a single cord. In the mixing chamber for the combined

stream, there is a turning shaft and arms fastened thereon which serve to mix the streams led into the chamber.

MEANS FOR SECURING CRANK HANDLES.—A. KARNAT, Baten, Courland Government, Russia. The invention provides a handle adapted particularly for meat choppers. An improved method of securing the handle is provided whereby it may be removed readily to permit of taking the knife and feed worm out of the meat chopper for the purpose of cleansing the knife and the body of the machine.

VENDING MACHINE.—G. D. BRUGGEMANN, 311 Dodd Street, West Hoboken, N. J. A machine for vending packages preferably of cylindrical shape is provided by the present invention. The hopper in which the packages are contained has its outlet normally closed, but when a coin is placed in the slot, the outlet becomes operative, and upon operating means manipulated from the outside of the casing, the package is delivered from the hopper.

FRUIT WASHING MACHINE.—A. R. STEVENS, care of Gulf Iron Works, Tampa, Fla. The invention provides a fruit washer which has comparatively few moving parts and therefore is not liable to get out of order easily. It is adapted particularly for washing oranges or lemons and comprises a means for rotating the fruit so as to expose all parts to the cleansing action.

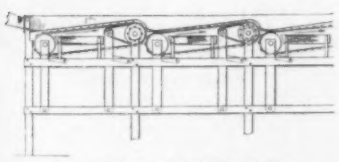
FRUIT SIZER.—A. R. STEVENS, care Gulf Iron Works, Tampa, Fla. The object of this invention is to provide a device by means of which fruit may be graded into sizes according to the largest diameter of the fruit. A further object is to provide means for adjusting the parts of the sizer so as to vary the sizes of the fruit deposited at any one point.

BOX PRESS.—A. R. STEVENS, care Gulf Iron Works, Tampa, Fla. The present invention relates to box presses utilized to press and hold the cover on a fruit box while it is being nailed and strapped. The invention provides simple and inexpensive apparatus in connection with such a press which will be durable and effective in use and which embodies certain novel features of construction.

SAWMILL.—R. H. ORR, R. F. D. Route 3, Sebastopol, Cal. Mr. Orr's invention is an improvement in sawmills, and has for its object to provide a simple and easily operated machine in which the saw is capable of a large variety of adjustments, both when in horizontal and when in vertical position.

TORPEDO STEERING MECHANISM.—J. J. DALLIER, Great Lakes, Ill. Among the principal objects of this invention are: To provide means for maintaining a torpedo on a relatively straight course, to provide an operating mechanism for a steering gear, to effect the abovementioned purposes easily and positively, and to provide operating means for the steering rudder, said means being removable from service position, without loss of time and without undue effort.

MACHINE FOR GRADING FRUIT.—F. C. and C. M. JAQUETTE, R. F. D. No. 1, Grand Junction, Colorado. An improvement in fruit graders is provided by the present invention, which has for its object to furnish a mechan-



MACHINE FOR GRADING FRUIT.

ism adapted for grading fruit as it is moved by endless carriers, and wherein a series of carriers is provided, each arranged to deliver from the machine all fruit below a certain size.

COMBINED BORING MACHINE AND LATHE.—H. J. WYATT, Longbranch, Washington. The object of this invention is to provide an improved boring machine and lathe arranged to permit of convenient use for boring or turning purposes, the machine being provided with a spindle capable of receiving a boring tool or a face plate, and the spindle being mounted to turn and to slide in the direction of its axis.

LOOP SETTER.—J. M. TRIPLETT, 6 North Columbia St., Wenatchee, Washington. This invention relates to moving picture apparatus and provides means for setting the loop of the film without interfering with the operating of the machine. The mechanism is of a simple nature under the immediate control of the operator. It is adapted for use in connection with any standard moving picture machine.

MEASURING AND DELIVERING MACHINE.—H. A. RUETSCHI, Box 626, Hammond, Ind. The object of this invention is to provide an improved measuring and delivering machine more especially designed for measuring and delivering loose material, such as coal, grain, ore, and the like, and arranged to insure the free passage of this material from a supply chute to a measuring receptacle.

PROJECTING APPARATUS.—J. H. GENTER, 13 Golden Street, Newburgh, N. Y. It is the object of this invention to provide an improved projecting apparatus more especially designed for use as an advertising medium and arranged to display the images of desired advertising matter on a screen, wall, sidewalk, or other surface, together with a revolving image having differently colored sections to form an attractive feature of the display.

SAWING MACHINE.—J. M. STEWART, 921 Poplar Street, Wilmington, Delaware. The invention has for its object to provide an improved sawing machine arranged for quickly and conveniently sawing trees with a view to felling them, and to allow of sawing the felled tree or log into desired lengths of cordwood lumber and other mill material.

AUTOMATIC ANNUNCIATOR.—J. H. GENTER, 13 Golden Street, Newburgh, N. Y. The invention relates to a projecting apparatus for projecting pictures or other subject matter on a screen, walk, sidewalk or other surface. The annunciator is arranged to announce automatically the time and legends representing advertisements or titles to vaudeville acts, or titles for moving pictures, or the like.

Medical Appliances.

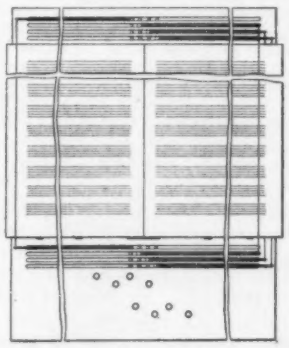
SANITARY MEDICAMENT EJECTOR.—C. E. BRASEFIELD, care of R. C. Collins, Schuylkill Fruit Building, Pottsville, Pa. Mr. Brasefield's invention provides an improvement in the class of devices comprising a rigid tube and an expansible soft rubber bag attached to the tube, for use in applying a medicament to the affected portions of the mucous membrane lining cavities of the body.

Musical Instruments.

MUSIC TURNER.—J. E. POOL, Wetumka, Okla. The invention provides a mechanism for turning the leaves of a piece of music in succession. The mechanism is operated by the foot of the player, and is so arranged that it may be applied to a piano without radical changes in the construction of the instrument.

ROSIN CAKE.—D. C. LOHMANN, West Milton, Ohio. The invention relates to a cake of rosin for use in connection with the bows of stringed musical instruments. The rosin cake is formed with soft and hard rosin, the soft rosin serving to hold the hard rosin to the bow. In the soft sections bluing is incorporated, so as to whiten the bow.

MUSIC LEAF TURNER.—A. J. ILLIG, Box 19, Rozellville, Wis. The present invention provides a leaf-turning mechanism which is manually controlled, but motor-driven, as shown in the accompanying drawing, which is a face view of the apparatus. Rock shafts are provided, with arms extending above and below



MUSIC LEAF TURNER.

the music, while wires connecting the arms pass between the leaves of the music. By touching the proper button, any rock shaft may be operated to turn a leaf to the right or to the left, as desired.

Prime Movers and Their Accessories.

PISTON PACKING.—C. N. SOWDEN, Guantanamo, Cuba. The present invention is intended more particularly for embodiment in hydraulic pistons employing a cup packing, and it is the design of the invention to provide a novel means associated with the cup packing to prevent the latter from being forced between the piston and cylinder wall when either or both become worn.

BOILER AND SUPERHEATER.—J. A. FREY, Silver Spring, Md. An object of the invention is to provide a device by means of which steam which is generated in a boiler may be returned to a superheater disposed within the combustion chamber of the boiler whereby the steam is superheated for use in metallurgical operations, and in which steam at a lower pressure may be taken from the same boiler to run an engine or for any other suitable purpose.

ENGINE.—R. HUNTER, 1022½ Sprague Ave., Spokane, Washington. Mr. Hunter has invented an engine of simple design, being an internal combustion engine of the rotary type. The invention provides a governor mechanism adapted for controlling the fuel supply in addition to the usual cam-operated inlet valve.

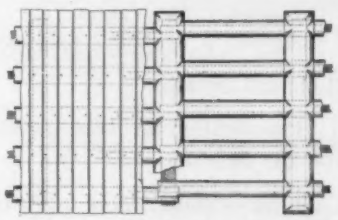
INTERNAL COMBUSTION ENGINE.—F. D. CALKINS and A. C. JOHNSON, Sunnyvale, California. The invention is an improvement in internal combustion engines, and has for its object the provision of a removable liner for the valve chambers of the engine, shown in a series of patents still pending, on means of permitting the linings to be removed, when worn, and replaced by others.

Railways and Their Accessories.

HYDRAULIC WEIGHING SCALE.—E. J. WALTERS, Groveland, and W. P. SYMONDS, Arlington, Cal. The invention relates to hydraulic-weighing scales, more particularly of the type used for weighing heavy articles, such as cars of a railway train. In operation, the cars of a train are drawn successively and slowly over the rails on the weighing scale, and a record of the weight of each is made automatically upon a chart.

EXTENSION-PLATFORM FOR CURVED RAILWAY-STATIONS.—J. J. PORTH, 72 Main St., Corona, N. Y. To close the gap between a car and a curved station platform and thus avoid accidents from persons falling between the platform and the car, Mr. Porth has provided a series of extension devices, consisting of spring-pressed platform sections, which are normally projected beneath the station platform, to intercept the spaces between the cars and platform.

BRIDGE.—O. FREENY, Carthage, Miss. The invention relates to simple and effective means for protecting and prolonging the life of sills and sleepers of bridges. Sheet-metal shields are provided, which extend longitudinally and transversely above the sleepers and the sills, to



PROTECTOR FOR BRIDGE SILLS AND SLEEPERS.

protect them from water dripping through the cracks between the transverse flooring strips. The life of the sills and sleepers is thus greatly prolonged, and it is merely necessary, from time to time, to replace the flooring.

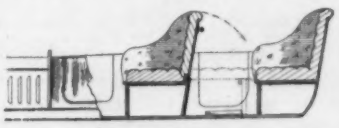
AUTOMATIC TRAIN STOP.—P. N. MATHIS, 1639 Pacific Street, Brooklyn, N. Y. The invention has particular reference to means for preventing an electric car or a locomotive equipped with air-brakes from passing a danger signal, except under direct orders and at low speed. The invention provides mechanism under control of a semaphore or other signal arranged to engage a device carried at the top of the locomotive or car when the signal is kept at the danger point.

VESTIBULE CAR CURTAIN HOLDER.—M. J. ROCHE, 63 Wayne St., Jersey City, N. J. The invention relates to improvements in curtain holders for vestibule cars, and has for its object to provide an improved structure which may be readily attached and detached, and which will automatically become detached when a predetermined strain is brought thereon, whereby the curtain is released without tearing.

FENDING DEVICE.—M. COHEN, 62 Avenue B, New York, N. Y. The invention provides a fending device adapted to be applied to street cars, automobiles, or other vehicles. The device comprises a movable shield adapted to be locked automatically in front of the fender, to shield a person struck by the fender and prevent him from being rolled or thrown to a position to be run over by the car.

Pertaining to Vehicles.

HINGED SEAT FOR VEHICLES.—J. L. BEESON, Milledgeville, Georgia. The object of this invention is to provide the front seat of an automobile or other vehicle with a back which may be let down so as to form, in connection with the rear seat of the vehicle, a bed.



VEHICLE SEATS CONVERTIBLE INTO BED.

This would be found particularly useful for camping purposes. The design is such that when the seat back is replaced in its normal position, it will have the appearance of a seat of the ordinary construction.

AUTOMOBILE LOCK.—F. O. ULRICH, care of John O. Ulrich, Tamaqua, Pa. The invention provides a means for locking the steering wheel of an automobile to the bearing-post sleeve, so as to prevent unauthorized interference with the wheel during the absence of the owner. It consists of a bolt mounted on the wheel and movable from the bearing sleeve, together with means for holding the bolt in operative or inoperative position.

REAR-END SIGNAL FOR VEHICLES.—C. F. MARSTON, 104 India St., Brooklyn. Mr. Marston provides a foot-pedal controlling mechanism for a vehicle whereby the driver of the vehicle may actuate signs selectively to indicate his intentions, the sign being placed at the rear of vehicle, but being selected with the foot pedal electrically.

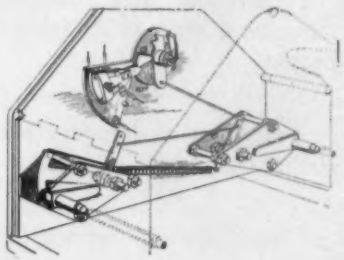
DRAFT EQUALIZER.—A. LANGE, care of H. M. Kidder, Fremont, Nebr. The principal object of this invention is to provide means for equalizing the pulling strain exerted by a widespread team, to provide a spreader for distributing a team to advantage irrespective of the line of draft and to provide a hitching device whereby unequal pulling strains are equalized.

SPRING WHEEL.—G. E. CRAWFORD, Britton, Okla. This automobile wheel comprises a hub, side plates carried thereby and formed with elliptical seats, spacing blocks alternating with the seats and formed with screw threads, radially disposed spiral springs with elliptical ends accommodated in the seats and engaging the threads of the spacing blocks and a rim projecting radially into and engaging the outer ends of the springs.

TRACTION WHEEL.—S. H. SUMMERSCALES, Box 1891, Winnipeg, Manitoba, Canada. In the present invention a traction wheel is provided with a plurality of spuds, for contact with the ground to cause the wheel to "take hold" while the spuds themselves do not sustain the load. The arrangement is such that the spuds contact with the ground in advance of the contact of the wheel tread.

CUSPIDOR ATTACHMENT FOR VEHICLES.—W. M. CARSON, Stovall, Miss. In carrying out this invention Mr. Carson provides the floor of an automobile or other vehicle with an opening which is normally closed by a spring door that is adapted to be retracted and opened by pulling a device connected thereto and easily accessible to the occupants of the vehicle.

LOCKING DEVICE FOR AUTOMOBILE HOODS.—A. E. MARSHALL, Box 215, Asheville, N. C. The object of this invention is to provide means for locking or unlocking automobile hoods so as to prevent access to the engine or



LOCKING DEVICE FOR AUTOMOBILE HOODS.

other parts contained therein. The locking mechanism serves also as a means for actuating a switch to cut out the sparking circuit. Both sides of the hood, as well as both ends, may be simultaneously locked or unlocked.

Designs.

DESIGN FOR WALL PAPER.—E. J. WALENTA, Sr., care of Standard Wall Paper Co., Hudson Falls, New York. The design for wall paper represents a scene through a wooded lane with hills in the background.

DESIGN FOR A HAMMERHEAD.—W. J. FLEISCHAUER and H. RICHARDSON, 159 Hayne Avenue, Pontiac, Michigan. The distinguishing feature of this design consists in providing at the side of a hammer head a flat circular boss.

DESIGN FOR WALL PAPER.—E. C. BAECK, 233 37th St., Brooklyn, N. Y. The patent covers an ornamental design for wall paper, in which the effect of a woven fabric is produced.

DESIGN FOR A GAME BOARD.—M. J. FITZGERALD, Lancaster, Los Angeles County, California. The game board bears on its face a picture of an animal, such as a bear, with a series of circles symmetrically disposed on the board and numbers printed in the circles.

DESIGN FOR A THREE-VALVE SHOWER-BATH BODY.—F. BOCKELMAN, 551 W. 174th St., New York.

DESIGN FOR A TWO-VALVE SHOWER-BATH BODY.—F. BOCKELMAN, 551 W. 174th St., New York.

DESIGN FOR WALL PAPER.—E. C. BAECK, 233 37th St., Brooklyn, N. Y.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Forty-five Years of Air-brake Evolution

(Concluded from page 498.)

severe service requirements were for a long time partly offset by closer inspection, better maintenance and more care and skill in the handling of the equipment in service.

Recent Improvements in the Air Brake.

The nature of the mechanism, itself, however, has been rapidly and radically modified.

The brake apparatus, in the first place, has been reconstructed so that the mechanism on each car assists in propagating the application in routine as well as in emergency use, thus insuring the prompt and uniform action of all the brakes and affording a more responsive brake for the train as a whole. In "releasing," uniformity and certainty are attained by automatically restricting the release and recharging of the brakes at the head end of the train. This insures greater certainty of response of the brakes toward the rear end of the train and a more uniform action on the train as a whole and is a large factor in preventing the shocks and strains which cause rough handling and break-in-twos.

To meet down-grade conditions the "empty and load" type of brake has been evolved. Instead of the ordinary brake, designed to control the empty car, and about one-third as efficient with a loaded car, we have for heavy grades the "empty and load" brake providing a braking force on each car substantially in proportion to its weight. The more uniform braking of loaded and empty cars improves level as well as mountain-grade service, since any inequality of braking effort on different vehicles in mixed trains of loads and empties produces rough slack action and damaging shocks.

Increased consumption of compressed air took place through greater loss by leakage for longer trains and larger cars, through greater actual use on the larger cars and in more frequent and heavier brake application. To augment the supply of compressed air, compressors of large capacity and high efficiency have been developed.

While the brake could be made quicker acting and more powerful by propagating the application through the train more rapidly, by raising the cylinder pressure and by shortening the time required in obtaining this high maximum pressure, thus making substantially safer the passenger train with heavy cars, it came to be recognized that full results depended upon transmitting the enhanced and quickened pressure to the rim of the wheel efficiently and without material loss. This brings us to the foundation brake rigging—the brake beam and levers—and the brake shoe. Inefficiency in these parts of the mechanism, as the Lake Shore tests of 1909 graphically demonstrated, made it impossible to reduce the length of emergency stops on heavy passenger trains going sixty miles an hour to less than 1,200 feet with the most powerful and rapid-acting brake then available. The result has been a highly efficient "clasp" type of rigging; two brake shoes to the wheel instead of one greatly improved the performance of the rigging and relieved the brake shoes, trucks and journals of excessive and unbalanced forces to such an extent as to permit the stops already described at well under 1,000 feet.

Routine or "service" stops, as previously pointed out, are second in importance only to emergency stops. The service functions have been improved so that a fully effective automatic or manual emergency application is possible, even at a moment when a "service" application is in progress. In case the brake-pipe reduction is continued below a fixed minimum danger point an emergency application is made automatically. By the use of electro-pneumatic control the application and release of all brakes can be made uniform and simultaneous throughout the train.

The motive of economy as well as that of safety has been assuming more and

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No. 9367. Wanted the name and address of a manufacturer of an automatic centering machine.

Inquiry No. 9368. Wanted, the name and address of glass-bottle manufacturers or glass blowers who can manufacture a glass bottle and perforate it with some 12 small holes, in large quantities for export, to sell at a popular price.

Inquiry No. 9369. Wanted, the names and addresses of users of Indian Steatite (Soapstone), Corundum and other Indian minerals, in quantities.

Inquiry No. 9370. Wanted the names and addresses of manufacturers of small wooden articles, particularly in such soft woods as pine and fir, for articles such as toys, furniture, etc.

Inquiry No. 9371. Information wanted where one could buy or have made to order machine to be used for making solid back brushes

Inquiry No. 9372. Wanted the name and address of manufacturers of a collapsible box about 12 inches square. It must be strongly made to withstand rough usage in transit.

Inquiry No. 9373. Wanted the name and address of a manufacturer of machinery that will make twine out of scrap paper.

Inquiry No. 9374. Wanted the name and address of manufacturers of a powder paste which, when mixed with cold water, will make a white paste suitable for papering, costing no more than 3 cents per pound in ton lots.

Inquiry No. 9375. Wanted the name and address of the manufacturer of a separable fastener, invented especially for shoes and other articles.

Inquiry No. 9376. Wanted, the name and address of a manufacturer making clock-work mechanism for running window display machines as employed by safety razor manufacture.

Inquiry No. 9377. Wanted, the names and addresses of factories making farm implements for export.

Inquiry No. 9378. Wanted, the name and address of a manufacturer of smooth metal mirror frames, such as are sold in 5 and 10 cent stores, with a mirror and a cardboard back.

Inquiry No. 9379. Wanted, meteorites—information desired concerning available specimens.

SCHOOLS

more its true position, and the present appreciation by railway officials and manufacturers of this aspect of the braking art promises still further progress in the future.

Making Money Out of Butterflies

(Concluded from page 505.)

kind of food plant shall be at hand; and some few cannot be induced to do their duty under any circumstances, though coaxed in every way possible. But when a female butterfly does lay she makes all efforts on the part of her keeper seem worth while. Often she produces anywhere from one to three hundred eggs. It is hardly profitable to maintain in captivity the commoner species; dealers can use but few of them as a rule. However, as Miss McGlashan soon discovered, the beginner had better secure all the varieties possible. The experience is valuable. Males necessarily must be admitted for breeding purposes. After mating, however, the sexes should at once be segregated.

The feeding of the captives is no problem. They thrive equally well on dried apple soaked in honey or sugared water. A bit of this may be fed daily.

Members of the rarer species bring big prices. There are some butterflies in the Sierra Nevada Mountains worth five dollars each. Incidentally, it might be worth while for the amateur butterfly farmer to know that these mountains also produce a beetle that dealers are anxious to snatch up at that same substantial price of $5 a head. This beetle makes an excellent side line.

But $5 apiece pales into insignificance compared with the almost fabulous sums that certain elect lepidoptera command in Europe. Some of the butterfly farmers there have reared specimens selling for $5,000. An Englishman named Head, who has been in the business for nearly thirty years, has disposed of hundreds of thousands of "flies," and holds the doubly envious position of having made a fortune from his enterprise, and of having become a world authority on the rearing of the insects.

Miss McGlashan does not market her "crop" on the basis of individual value of specimens. She has a contract, whereby she receives a uniform price for all, whether rare or common. The reservation, however, has been made by the dealer that the commoner varieties shall be limited to one hundred each.

To catch moths, sugared cloths must be stretched while it is still daylight, on the trunks of trees. If one throws a light upon these cloths after darkness falls, many moths will be found gathered feeding. A carbide lamp is the best for the purpose. It will not blow out in any wind. The price is about two dollars. The light-dazed moths are easily swept into wide-mouthed bottles.

Larvæ or caterpillars, which should be captured whenever found, are also quite easily taken at night. Where the leaves of bushes or trees appear as if they have been fed upon, trays, paper, or sheets should be set upon the ground directly beneath. At 9 o'clock or even later, the raid may be made upon the larvæ. The bushes and branches must be beaten vigorously with a stout rod or pole to break the hold of the feeding larvæ. Dozens, even hundreds of caterpillars, have been taken by Miss McGlashan in this manner in a single evening. Larvæ should be taken even more eagerly than the fully developed female butterflies. The intermediate stages of egg-laying and hatching can thus be dispensed with. The taking of both moths and larvæ can, of course, be combined the same evening. It is advisable to do this work alone as moths are easily frightened away by noise.

All the work of butterfly breeding centers in the care of the caterpillars. It is of vital importance, first of all, that the little creatures have their own sort of food. Usually this may be known, of course, by a knowledge of the sort of bush the captives were found feeding upon. However, where the farmer has hatched his caterpillars from eggs, a problem pre-

sents itself. But the right sort of food plant may be discovered by making various experiments, half a dozen different varieties of leaves being introduced each day until it is observed that the larvæ begin to cluster upon some one of these. There is no danger of immediate starvation, for they will subsist for a little time upon the shells from which they have been hatched.

Miss McGlashan found that test tubes are the best place in which to keep the eggs. As they must be examined every day to see whether or not they have hatched, the importance of having transparent receptacles that may also be easily handled, is obvious. The eggs of some species of butterflies will hatch within a few days, others not until the following Spring. Larvæ and eggs should be put in cold storage for the Winter. The reason for this is that the food plants not being available, the caterpillars would starve. Thus, the eggs will not hatch till Spring, and the caterpillars will hibernate until warmer days arrive.

At intervals larvæ molt. This process goes on half a dozen times during the crawling stage of their existence. When they begin to spin cocoons, the nursing period for the farmer is over. His last step is to remove the cocoons to a barrel or box securely covered with gauze.

Miss McGlashan thus gives directions for taking care of young caterpillars:

"A few days after they have hatched, remove your brood of worms to a jelly glass having a tight-fitting tin cover. They may remain here until they become a quarter of an inch in length. Then place them in large-mouthed bottles with tight-fitting covers. They require very little air. Large bottles or fruit jars make fine breeding cages for broods of caterpillars. A candy jar is ideal, because you can watch the development of the larvæ through the thin, transparent glass. If you have hundreds of a kind, get a tight barrel, loosen the top hoop, place a covering of cloth or gauze over the open head of the barrel and fasten it down closely by means of the hoop, and you have a first-class breeding cage. Three inches of dirt and leaf mold should be placed in the bottom of each bottle or barrel used for larvæ, because they love to hide in this during the daytime, and many species bury themselves before they pupate. Put in fresh leaves of the food plant daily, take out the old food, and keep your breeding cages clean. Of course, you may build elaborate cages of wire gauze, but the simple ones are just as good."

The Improvement of the Irish Potato has been the subject of much recent investigation on the part of the United States Department of Agriculture. An initial step has been the exploration of that portion of South America of which the potato is supposed to be a native. Convincing proof has been obtained that this plant was indigenous to the high Andes region of both Peru and Bolivia, where it has been under cultivation for 2,000 years. Experts of the Department have collected more than 250 sorts of cultivated and wild potatoes, which will be used in the development of more vigorous races especially adapted to the diverse areas over which the potato is cultivated in the United States. The Department is also investigating new methods of utilizing potatoes analogous to those that have been so successful in Germany.

Salton Sea continues to dwindle in size and increase in salinity through evaporation. The last (seventh) annual analysis of its water, made by A. E. Vinson, showed that the total solids in the water had increased in a year from 846.55 parts to 1,002.56 parts per 100,000, an increase of 18.4 per cent for the period. The water may now be considered as 1 per cent brine.

Mr. J. I. Craig, late director of the meteorological service of Egypt, has been transferred to other duties in the Survey Department (of which the meteorological service is a branch), and is succeeded by Mr. H. E. Hurst.

NEW BOOKS, ETC.

ANIMAL FLIGHT. A Record of Observation. By E. H. Hankin, M.A., Sc.D., Associate Fellow of the Aeronautical Society of Great Britain. London: Iliffe & Sons, Ltd. 8vo.; 413 pp.; illustrated. Price, 12s. 6d. net.

The author once asked Lord Kelvin if he could explain the baffling phenomena of soaring flight, and received the answer, "That which puzzled Solomon puzzles me also." "Animal Flight" is largely devoted to bird soaring, although other modes of bird flight are included, and there are chapters dealing with bats, flying fishes, and dragon-flies. The volume is unique in that the writer has no theories of his own to proffer. He simply presents atmospheric conditions, time and space measurements, and actual accomplishments, leaving the field of deduction to those who may follow him. He has had splendid opportunities for intimate observation, and has not failed to make the most of them. There are instances of heavy birds soaring in calm, tropical air, and he differentiates between true soaring flight such as this and the more usually seen mode in which our birds of the temperate zone skillfully seek and utilize air currents. Although the author avoids speculation, it is clear that he believes the possibility of soaring flight to be traceable to a certain condition of the air, a static energy dependent in its turn upon sunlight. Hence we find him continually applying to the air the terms "soarable" and "unsoarable." Perhaps the more immediate value of the work lies in its studies of wing positions, camber, etc., in the various modes of flight.

NOTED MURDER MYSTERIES. By Philip Curtin. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. 8vo.; 301 pp. Price, 7s. 6d. net.

Without straining toward sensationalism, allowing the actual circumstance and situation to exert their own power, Mr. Curtin narrates nine of the world's strangest cases. Whether Marie Lafarge was martyr or murderess will probably never be known, but in its day her case rocked emotional France, and as retold by the present writer, still has the power to arouse in the reader strong conflicting emotions. But a very low wall divides the commonplace from the tragic. Certain stimuli are raised above the threshold of consciousness. The wall is leaped; and immediately some humdrum life appears before the world in all the colors of romance, with tonal values ranging from humor to tragedy. Strange flashlights play upon the inscrutable depths of human nature, and the observer is held motionless, fascinated. For those who care to indulge in this form of intellectual dissipation, "Noted Murder Mysteries" will furnish a ready means.

SUN LORE OF ALL AGES. A Collection of Myths and Legends Concerning the Sun and Its Worship. By William Tyler Olcott, A.M. New York: G. P. Putnam's Sons, 1914. 8vo.; 346 pp.

Those who are familiar with the author's companion volume, "Star Lore of All Ages," need no assurance that in beauty of format and wealth of illustration this later work is worthy of a place beside the former. From earliest times, and among the most primitive peoples, the heavenly bodies have made an intense appeal to religious, superstitious, and scientific instincts. Imperious and dominating among these celestial mysteries rides the sun, and the wealth of the mythology clustering about it is well represented and set forth in the twelve chapters of this work. In them is included the solar creation myths of the North American Indians, the legends of India, Persia, and Greece. The solar festivals of many lands are described, and their folk lore is frequently presented in the language of their own literatures. Thirty full-page plates embellish the text, many of them reproductions of beautiful sculptures and paintings that are not so well known as to carry with them that familiarity which, while it can never breed contempt in the artistic mind, yet takes off the finest edge of enthusiasm.

TERRY'S JAPANESE EMPIRE. Including Korea and Formosa. With Chapters on Manchuria, the Trans-Siberian Railway, and the Chief Ocean Routes to Japan. A Guide Book for Travelers. By T. Philip Terry, F.R.G.S. New York: Houghton, Mifflin Company. 12mo.; 1150 pp.; 8 specially-drawn maps, and 21 plans. 1914 Edition. Price, $5.

Aided by the use of thin but good paper, the author and publishers have packed a really astonishing amount of information into a volume that just comfortably fits the hand. The result is a guidebook dealing substantially with a great diversity of things. The "three R's" of the ordinary guidebook—routes, rates, and recreations—are supplemented by admirable little essays on art, architecture, language, and religion. The main portion of the book maps out seven routes which, together, include all the points and localities that offer special appeal to the tourist. The writer knows his business, as he knows his Japan, and his laborious and conscientious work should be eagerly welcomed by all who contemplate travel through or residence in this most interesting part of the world. Terry's "Mexico" is the standard guide to that much troubled (and troublesome) country, and is the only case where a Baedeker has been successfully emulated. We have no reason for believing that Mr. Terry will be less successful in his newest venture.

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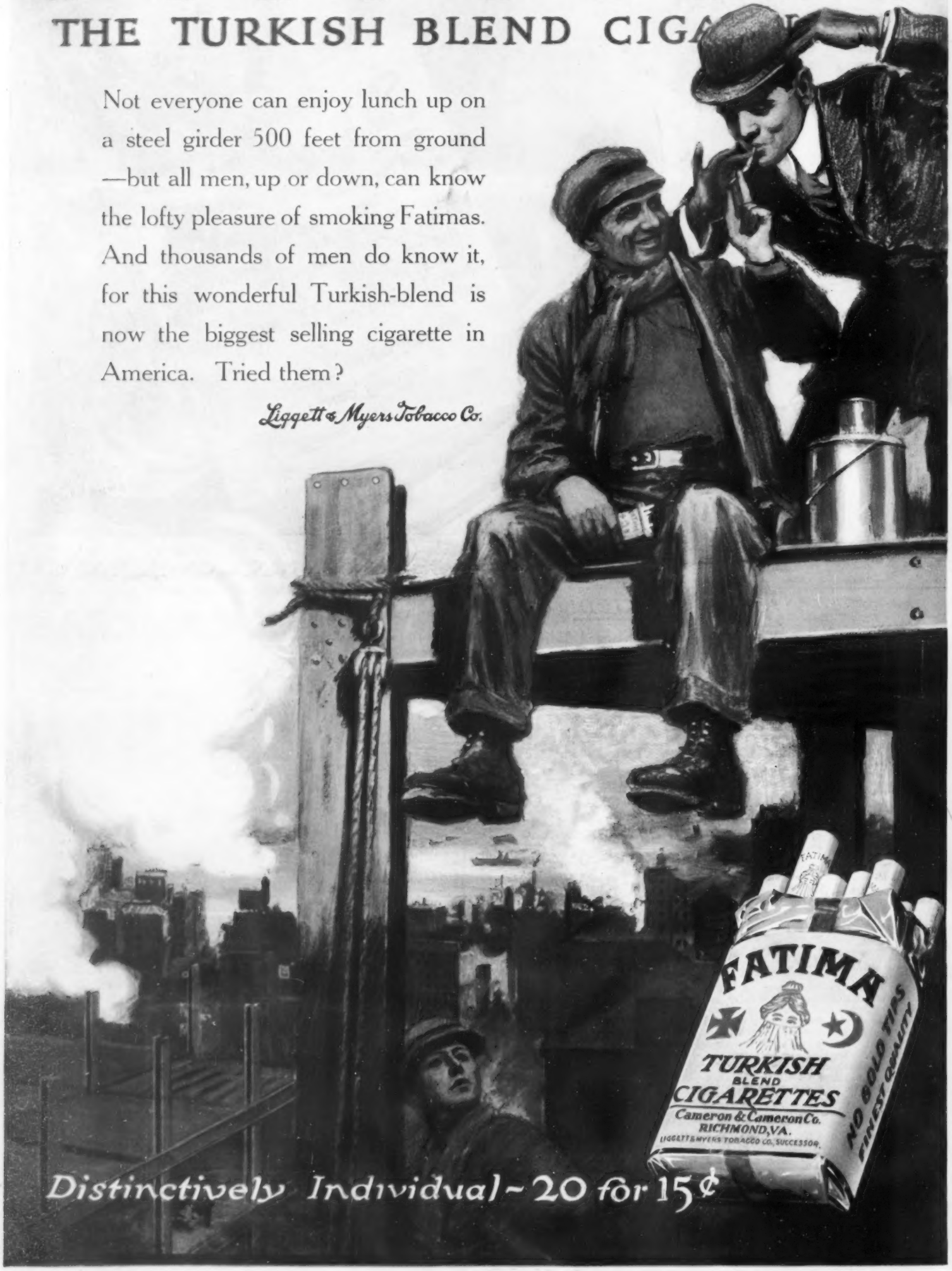

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